# IMMIGRATION, DIVERSITY AND ECONOMIC GROWTH:

# EVIDENCE FROM U.S. STATES

A Thesis
Presented to
The Academic Faculty

by

Atay Kizilaslan

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in the
School of Economics

Georgia Institute of Technology
August 2006

# IMMIGRATION, DIVERSITY AND ECONOMIC GROWTH:

# EVIDENCE FROM U.S. STATES

Approved by:

Dr. Rehim Kilic, Advisor
School of Economics
*Georgia Institute of Technology*

Dr. Maurizio Iacopetta
School of Economics
*Georgia Institute of Technology*

Dr. Willie J. Belton,Jr.
School of Economics
*Georgia Institute of Technology*

Date Approved: July 10, 2006

## ACKNOWLEDGEMENTS

I am endlessly grateful to Dr. Rehim Kilic for continuous guidance on research, valuable recommendations, without his kidness and help I would not go ahead with my ambition in academy. I would like to thank Dr. Maurizio Iacopetta for his help and guidance on study and graduation. I also wish to thank the other knowledgeable member of my committee, Dr. Willie J. Belton, Jr.

I wish to thank my dear friends Meltem Alemdar, Bulent Anil, Nevbahar Ertas, and Sinem Gokgoz Kilic for their help and the fun we had together. Last,but not least, I would like to especially thank Eray Kizilaslan and Funda Golcuklu. They always stand next to me with their endless support, and encouragement.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## SUMMARY

The literature of immigration has been examined the impacts of immigration on the labor market outcomes, consumer goods, and the formation of jurisdictions. Part of the literature stresses on the policy recommendations on how to deal with immigration in general. This thesis aims to add this extant literature by investigating empirically the impact of immigration on the long run growth of a country. Specifically, the thesis examines the impact of diversity on long run economic growth rate of forty eight states in the United States by using historical data on immigration and income since the second half of $19^{th}$ century. Initial analysis show that there is a negative relationship between the per capita income growth and immigration using both variables. In the further analysis, on the other hand, the results indicate the positive relationship between the per capita income growth and initial level of immigration.

# CHAPTER 1 - INTRODUCTION

Like several other developed countries, United States has been experiencing both positive and negative sides of the immigration and diversity. Although diversity has some costs, especially related with racial and ethnic crashes, it also plausible to think scenarios in which immigration and diversity (the notion of diversity is defined in the subsequent parts of this thesis) can enhance the economic performance of a country. This thesis aims to investigate the relationship between immigration, diversity and economic performance throughout providing a survey of the existing literature and empirically studying the growth experience of forty eight US states by utilizing more than a century of data.

The extant literature on immigration has examined the impact of immigration on the labor market outcomes, consumer goods, and the formation of jurisdictions. Part of the literature emphasizes on the policy recommendations on how to deal with immigration in general. The literature on diversity examines the impact of diversity on countries, cities or in small jurisdictions. Survey of the literature indicates that little research has been done on the impact of immigration, and especially diversity that emerges out of immigrants coming from different parts of the world to a country or state, and long run economic performance of a country. This thesis aims to add this extant literature by investigating empirically the impact of immigration on the long run growth of a country. Specifically, the thesis examines the impact of diversity on long run economic growth rate of forty eight states in the United States by using historical data on immigration and income since the second half of $19^{th}$ century.

Introduction of immigration into the neoclassical growth model indicates that immigration decreases in the average stock of capital, and so does the average per capita

income. Immigration also leads economy to grow faster in the past as the arrival of immigrants has diluted the amount of capital. But, the model does not take the possible impacts of diversity on the economic growth into consideration. Diversity may imply variety of production skills, of abilities and of occupations that enhances the productive performance of the economy. Diversity can create potential benefits by increasing the variety of goods, services and skills available for consumption and production. Furthermore, by bringing together different abilities, complementary skills, and alternative approaches to problem solving, diversity may also boost creativity, innovation and ultimately growth. On the other hand, transaction costs and frictions across ethnic groups may hurt productivity. Diversity can generate costs from potential conflicts of preferences, hurdles to communication, or outright racism, prejudice of fear of other groups, leading to a suboptimal provision of private and public goods. Easterly and Levine (1997) find that, income grows less in countries characterized by diversity than in more homogeneous ones. Collier and Gunning (1999) explain such behavior in terms of mutual distrust among ethnic groups, which makes it difficult to build social capital and share productive public goods.

This thesis will investigate empirically the impact of immigration on the long run growth of a country by employing different techniques. Following the Barro's (1991) exercise, we plot of per capita GDP growth and immigration, where the immigration is measured by two different variables. The first one is the percentage of foreign population. The second one is the diversity index that we developed. You can find the details of these variables in the data section. The initial plots show the negative correlation between the per capita GDP growth and diversity. Then, we regress the per capita GDP growth on the

initial level of income. The results, consistent with the literature, show the negative relationship with the per capita GDP growth and the initial level of income. We also plot the residuals of the regression with the immigration variables, so that we can show the relationship between the growth and immigration after controlling the initial level of income. We get negative relationship when we use the percentage of foreign population as the immigration variable. Where as, we have the mixed results when we use the diversity index as the immigration variable.

In the next step of the analysis, we use the panel data models. In terms of the relationship between the initial level of per capita GDP and the per capita GDP growth, the results, consistent with the previous analysis, show the negative relationship. The sign of the relationship between the immigration and the per capita growth, on the other hand, changes with the immigration variable. The results reveal the negative relationship between the per capita GDP growth and the percentage of foreign population. Where as, we notify the positive relationship between the per capita GDP growth and the diversity index.

This thesis organized as follow. Chapter 2 introduces the relevant theories and literature. It starts with the immigration theory, where we present the immigration theory and empirical evidences. In the next section, we present the diversity literature. It starts with the related theories, and then discusses the pros and cons of the diversity. This section continues with the discussion of the empirical evidences, and concludes by discussing several open questions in the area of research. The last section of chapter 2 discusses the growth models. The discussion starts with the Solow-Swan growth model, and then move forward to the growth models with immigration. Chapter 3 starts with the

presentation of the data. Then we will introduce the initial analysis. It starts with the discussion of methodology, and then presents the evidences from our analysis. Last part of the Chapter 3 discusses the panel data models, and presents the empirical results. Chapter 4 concludes.

# CHAPTER 2 - THEORY AND LITERATURE

In this thesis, we will investigate the impacts of immigration on the economy using the growth model. This chapter presents the theories and discusses the literature related with our question. At first, we present the immigration theories, and empirical evidences related with the theories. In second part, we will present the diversity literature. It starts with the theories, and then discusses the empirical evidences. The section concludes with discussion of open questions in the area of research. In the last section, we will introduce the growth models. We start to discuss with neoclassical growth models, and then we present the growth models with immigration.

## *2.1 Immigration: Theory and Empirical Evidences*

With the emergence of globalization, immigration and its consequences has become an important research area for economists. They have been working on the dynamics and consequences of immigration.

The important result of economic theory states that labor market impact of immigration depends on how the skills of immigrants compare to those of natives in host country. Based on this result, most of the research efforts in immigration literature worked on the following three areas:

1. understanding the factors that determine the relative skills of the immigrant flow
2. measuring the relative skills of immigrants in the host country
3. Evaluating how relative skill differentials affect economic outcomes.

In this part, we address these questions. First we discuss with immigration and host country. Then,we shall present the theoretical foundations of immigration. Lastly, we will report the researches done in the immigration literature so far.

### *2.1.1 Immigration and the Host Country*

The researches reveal that the immigration is beneficial to the host country as long as the natives and the immigrants differ in their productive abilities. The greater the difference in skills of immigrants and natives, the larger the benefits are. If the skills of natives are compliments of those of immigrants, host country will benefit. If they compete, host country will lose. In the explanation of how immigration affects the labor market in the history, there are three basic models.

In the first model, it is assumed that natives and immigrant workers are perfect substitutes, in other words there is a homogenous labor. This model states that net gains of immigration to the host country depend on the adverse impact that immigration has on the wage of competing native workers. The natives gain substantially from immigration, if increase in the labor force significantly decreases the wages. However, the model assumes that the host country's capital stock is fixed. When the assumption of fixed capital stock is relaxed, the immigration does not change the price of labor or the returns of capital because the immigration induced capital flow reestablishes the pre-immigration capital/labor ratio in the host country. Thus, natives neither gain nor lose from immigration.

In the second model, it is assumed that there is heterogeneous labor and perfectly elastic capital. This model claims that the effect of immigration on wage structure is entirely determined by how the skill distribution of immigrants in compare to that of

natives. If two skill distributions are same, immigration will have no affect on wage structure of the host country. If immigrants are relatively skilled, the skilled wage decreases, and the unskilled wage rises. On the other hand, if immigrants are relatively unskilled, the unskilled wage decreases, and the skilled wage rises. In other words, the impact of immigration on wage structure of the host country depends on the relative skills, not the absolute skills of immigrants.

In the last model, it is assumed that there is heterogeneous labor and inelastic capital. The model concludes that immigration surplus is maximized when the immigrant flow is exclusively skilled. Negative elasticity of factor price for skilled workers implies that skilled workers are highly complementary with other factors of production, especially capital. Due to this complementary nature between native owned capital and skill, it is better to admit skilled workers. However, this conclusion may change if the native work force is chiefly skilled. Under this condition, there are two conflicting motivations. On one side, the host country admits immigrants who most complement the native owned capital, or skilled immigrants. On the other side, the host country admits immigrants who most complement the skilled natives, or unskilled immigrants.

On the empirical side of the story, researchers simulate these theories of impact of immigration. Borjas(1995a), Borjas, Freeman, and Katz (1997) and Johnson (1997) used those models to simulate the consequences of immigration on the U.S. labor market. Those studies show that if the capital is elastic, unskilled workers lose and skilled workers gain a little. However, if the capital is perfectly inelastic, all workers lose and capital gains substantially. The national income accruing to natives rises under both perfectly elastic and inelastic capital. In sum these simulations show that regardless of

how workers are grouped into different skill categories, and of the assumptions made about the supply elasticity of capital and the factor price elasticities, the overall impact of immigration on the U.S. labor market is small.

*2.1.2 Immigration: Theoretical Foundations*

The previous section tells us that the economic impact of immigration depends highly on the differences in the skill distributions of natives and immigrants. In order to explain the skill difference between the immigrants and the native workers, economist has done a lot of theoretical and empirical researches. One of the most important findings of these researches is that the immigrants are not a randomly selected sample of the population of the source countries. Thus, analysis of skill difference between the immigrants and the native workers should start with an analysis of factors that motive the immigrants to leave the source country to migrate to host country.

In order to explain the migration decision, Borjas (1987,1991) comes up with two country model. He suggests two different wage equations for host and source countries. At the beginning, he assumes the same skill level. By doing so, the impact of the selection process on the skill composition of the immigrant flow is isolated and, this assumption presents a simple way for comparing the skills of natives and the immigrants in the host country. Two equations describe nothing but the earning opportunities available to persons born in the source country. The insight that migration decisions are motivated chiefly by wage differentials can be ascribed to Sir John Hicks. In his very famous book "The Theory of Wages", Hicks(1932,p 76) discussed that " differences in net economics advantages, chiefly differences in wages, are the main causes of migration.". All the modern studies of migration decision use this statement as a

beginning point. Based on Hick's theory, it can be said that the emigration rate decreases when the mean income in the host country decreases, when the mean income in the source country increases, and when time-equivalent migration costs rise. Most of the researches about this theory prove this statement (Greenwood, 1975)

On the other hand, Ray thinks that determining which person thinks it most meaningful to migrate to host country is also as important as determining the size and direction of migration flows. Therefore, he build the Roy Model (Roy,1951; Heckman and Honoré,1990)around this question. The Roy model defines three cases that summarize the skill differentials between immigrants and natives. According to model, when immigrants have above average earnings in both source and host country, positive selection occurs. The negative selection occurs when the immigrants have below average in both countries. The model requires that skills should be positively correlated across countries. The model also states that immigrants positively selected when the source country, relative to the host country, taxes highly skilled workers and insures less skilled workers from poor labor market outcomes, and when the host country taxes highly skilled workers and subsidize less skilled workers, immigrants are negatively selected. The model shows that neither the level of migration costs nor the average income differences among the countries determines the type of selection that characterizes the immigrant flow. Those factors influence the size of the flow.

The Roy model provides estimates about how immigrants compare to the population of the source countries. When we want to determine the impact of the immigration of the host country, this contrast is not relevant. The discussion introduced the native immigrant comparison with the assumption that the average person have same

skill levels in both host and source country. However, it is a well known fact that different countries have different skill distributions. For this reason, the skill difference between the immigrants and the natives in the host country will depends both on the average skill difference between the source and host countries and the selection rules.

The implications of the Roy model are tested by several empirical researches. The researches support for the hypothesis that immigrants originating in countries with higher rates of return to skills have lower earnings in the United States. Borjas (1987,1991) finds that measures of income inequality in the source country, tend to be negatively correlated with the earnings of immigrant men. Cobb-Clark (1993) reports similar findings for immigrant woman. Barrett (1993) reports that if immigrants, who enter the U.S. using a family reunification visa, come from countries where the variance of the income distribution is large, they have lower earnings. Bratsberg(1995) shows that the foreign students who remain in the United States after completing their education earn relatively high if their source country offers a low rate of return to skills, and earn less if their source country offers a high rate of return to skills.

The observed characteristics of immigrants are also important factors while determining the impact of the immigration on the host country economy. For example, Heckman(1979) shows that a one year increase in the mean education of the source country increases the mean education of persons who actually migrate, but less then one year. This inequality entails that the variance in mean education across immigrant groups who comes from different countries but live in the same host country is smaller than the variance in mean education across the different source countries. this means that relatively similar persons tend to migrate. Thus, selection process serves as a melting pot

before the arrival, and that makes the immigrant population of host country more homogeneous than population of the various countries of origin

*2.1.3 Immigration: Empirical Results*

Initially, the empirical analysis of the relative economic performance of immigrants was based on the cross-section regression model.

$\log w_l = X_l\beta_0 + \beta_1 I_l + \beta_2 y_l + \varepsilon_l$ where w is the wage rate of person l in the host country; X is the socioeconomic characteristics; I is a dummy if the person is foreign born and y is the number of years that immigrant resided in the United States. Chiswick(1978) found that $\beta_1$ is negative and $\beta_2$ is positive. His analysis of 1970 data shows that the immigrants earn about 17 percent less than "comparable" natives at the time of the entry, and this gaps gets smaller by a little more than 1 percentage point per year. So, the immigrants' earnings overtake the earnings of comparable native after 15 years in the United States. On the other hand, Borjas(1985) has alternative explanation for positive $\beta_2$. He stated that cross section data might be revealing a decline in relative skills across successive immigrant cohorts. United States witnessed major changes in the immigration policy and in the size and national origin mix of the immigration flow in the postwar era. If these changes created a less-skilled immigrant flow, the cross-section correlation indicating that the more recent immigrants earn less may say little about the wage convergence process; instead it reflects initial differences in ability or skill across cohorts. Therefore, another cross-section model was developed with different restrictions. However, they revealed different results.

Overall, the lesson is obvious: estimates of cohort and aging affects are conditional on the imposed restrictions. Imposing different restrictions cause to different estimates of the underlying parameters of interest.

There seems to be a great deal of confusion in the empirical literature about whether immigrants experience a substantial degree of "economic assimilation", even the analysis has let for the possibility of cohort effects. Some of the confusion derive from the definition of the assimilation. Chiswick(1978) and many others use the rate of wage convergence between immigrants and natives as the definition of assimilation. Where as, LaLonde and Topel(1992,p.75) suggest a different definition for assimilation. They state that assimilation occurs if, between two observationally equivalent persons, the one with greater time in host country typically earns more. Those are two different definitions of assimilation and address different questions.

The confusion about the measurement of economic assimilation has motivated some researchers to estimate the correlation between the skills of immigrants at the time of entry and the post-migration rate of human capital acquisition. In their resarches, Duleep and Regets(1996,1997) and Borjas(1997) find the following cases about the potential relationship between the log entry wage and the rate of wage growth. First, skilled immigrants invest less, earn more at the time of entry and experience less wage growth. Second, skilled immigrants devote the same fraction of time to human capital investments as less skilled do, but earn more. Third, skilled immigrants invest more, and they also have higher entry wages. Last, the rate of human capital investment is so high for skilled workers that they actually earn less initially. These cases sum up the

implications of human capital theory for the unconditional correlation between entry wages and the rate of wage growth.

The empirical studies using different U.S. Censuses show that there is a positive, but insignificant, unconditional correlation between the rate of wage growth and the log entry wage of immigrants. In other words, there is a weak relative complementarity between the skills that the immigrant acquire in the post-migration period and the skills that immigrant bring into the United States. However, Duleep and Regets(1997) find a great deal of wage convergence across immigrant cohorts as they are implicitly holding initial skills constant. Thus, the choice of base group is very crucial in the explanation of the relationship between the initial wage and the wage growth of immigrants. Generally, we can state that immigrant cohorts who start out with high wages are likely to have slightly faster wage growth.

Although the literature of explaining how immigration change the employment opportunities of native workers in a host country has grown in past decade, the econometric and conceptual problems, as we discussed above, plague this literature. Therefore, researchers try to find solutions to these problems in order to come up with better explanations for the phenomena. Some researchers, such as Grossman(1982) and Borjas(1983) use spatial correlation while explaining the impact of immigration. There are different spatial correlation studies in the literature. For example, Grossman(1982) and Borjas(1983) regress a measure of native economic outcomes in the locality on the relative quantity of immigrants in that locality, and the regression coefficient is interpreted as the immigration impact. However, there are two main problems about this method. First, immigrants may not be randomly distributed across labor markets. It is

well known fact that some cities in United States, like Los Angeles and New York, attract more immigrants than other cities do. The second problem about the spatial correlation approach is that natives may respond to the entry of immigrants in a local labor market by moving their labor or capital to other places until native wages and returns to capital are equalized again across areas. In more recent studies Borjas, Freeman, and Katz(1997) and Schoen (1997) use the immigrant supply shock in order to measure the impact of immigration. These studies reveal different results than the previous studies did. Thus, it is arguable that this literature increases our understanding of how labor market responds to immigration because of the different results of those spatial correlation studies. So, we can easily say that either the regression coefficients are simply not measuring what we think they should be measuring or we need different models to understand how supply shocks affect labor markets in different time periods.

In the empirical studies that measure the spatial correlation generally ignores the fact that the impact of immigration on labor market requires the combined analysis of the market outcomes and the native response to immigrant supply shock. There are few studies that attempt to explain whether there are a relationship between native migration decision and immigration. However, those studies reveal confusing results. Filer(1992) states that metropolitan areas where immigrants cluster experienced lower rates of native in-migration and higher rates of migration during the 1970s. Frey and Liaw(1996) also find a strong negative correlation between the immigration and the net migration rates of natives by using 1990 Census. Where as, in their research, White and Liand(1993) and Wright, Ellis and Reibel(1997) state a positive relationship between the in-migration rates of natives to particular cities and immigration flows in 1980s.

Borjas, Freeman, and Katz(1997) and Card(1997), on the other hand, were the first attempts to analyze the immigration and migration decision of natives jointly. Like the previous researches, the results of these researches were different. While Borjas, Freeman, and Katz report a strong negative correlation between immigration and native net immigration in 1970s, Card reports, on the contrary, a slight positive correlation between the 1985-1990 rate of growth in native population and the immigrant supply shock by metropolitan area.

Due to limitations of spatial correlations approach, Borjas, Freeman, and Katz(1992) proposed an alternative approached, called factor proportions approach. This approach compares a nation's actual supplies of workers in particular skill groups to those it would had had in the absence of immigration, and then uses outside information on the elasticity of substitution among skill groups to calculate the relative wage consequences of the supply shock. However, this approach is unsatisfactory because it does not estimate the impact of immigration on the wage structure; it rather simulates the impact. For this reason, the factor proportions approach departs from the traditional researches of labor economics which try to explain the impact of immigration.

## *2.2 Diversity: Theory and Literature*

At the beginning of 1990's, 9 % of the United States, 17% of Canada, 11 % of France were foreign born. Today, societies experience both the positive and negative effects of diversity. On one hand, diversity may increase the productivity, bring innovation and creativity. On the other hand, diversity may lead to social problems like conflict of preferences, racism, and prejudices. . In their paper, Alesina and La Ferrara (2005) examine the diversity in both cross-country and local community level. They find that the skills of individuals who come from different ethnic groups are complementary in private production so that diversity increases the productivity. However, they also report that different ethnic groups may lead the decrease in the utility from public good consumption because different ethnic groups have different preferences on the public goods. In this discussion, we shall present the literatue of ethnicity and its economics impacts by following the paper of Alesina and La Ferrara (2005).

### *2.2.1 Theories of Diversity*

Economic performance involve with different activities such as deciding on how much to save or figuring out how to distribute the scare resources. Ethnic diversity has an influence on those economic activities. The literature about the diversity covers different theories about how diversity influences those economic activities. One of those theories claims that diversity might have an influence on the economic decisions of individuals by directly entering to their individual preferences. The empirical researches support the theory and show that individuals attribute negative utility to members of other groups, where as they attribute positive utility to members of their own group. On the other hand,

another theory state that diversity has an influence on the strategies of individuals, and with that influence diversity can affect the economic outcomes. Related to the theory, Greif(1993) reports that in Medieval times trades formed coalitions along ethnic lines by exchanging information on their opportunistic behavior in order to monitor agents. Those ethnic coalitions helped to protect reputation mechanism in the presence of asymmetric information. However, it was also possible that individuals' strategies might depend on the one's ethnic identity in the presence of perfect information. More over, La Ferrara (2003a) shows that, membership in ethnic groups allows growth of the set of cooperative strategies that can be supported, when contracts cannot be legally enforced. Because both reciprocity and punishment can be directed not only at individual but also to other members of her/his group. Similar kind of reasoning is also proposed by Fearon and Laitin (1996) in order to explain interethnic cooperation. Another application of the strategic role of diversity involves the incentives to innovate through individual initiative. Berman (2000) uses a club good model with social interactions, and discusses that, small communities can ensure the loyalty of their members by taxing activities to outsiders. Bernard, et al. (2004), also study a situation in which local communities try to restrain innovations by subgroups. They report that differentiating organizations may actually emerge in local communities, once enough diversity exists.

Lastly, diversity affects the production function. Based on the theory, Hong and Page (1998) come up with two interesting results. First, a group of cognitively diverse problem solvers can find optimal solutions to difficult problems. Second, more diverse group of people with limited skills can outperform a more homogenous group of more skilled problem solvers, under certain conditions. Alesina et al. (2000) report that, total

output increases as the variety of individual skills increase. Lazear (1999a,1999b) also argues how different skills in a production unit might increase the overall productivity. He defines the trade off between the benefits and costs of diversity. Besides, another group of researches emerges from theory, which points out the trade off between the productivity and the level of heterogeneity. Jackson and Ruderman (1996), Williams and O'Reilly (1998) and Richard, et al. (2002) are the examples of those researches. However, most of them perform laboratory experiments to test the link between the diversity and performance, rather than real life applications. Some studies are done on real organizations but they offer a complex picture. For example, Kochan et al. (2002) report that, unless the specific organizational context and policies are accounted for, there is no significant direct relationship between the diversity and team performance

### *2.2.2 Costs and Benefits of Diversity*

Before furthering the analysis of impacts of ethnic diversity on economic activities, we would like to discuss more about the diversity, and introduce its advantages and disadvantages. Alesina and La Ferrara (2005) provide a simple model for the analysis of pros and cons of diversity. They show that a higher level of per capita input increases the benefits of variety and raises the optimal numbers of groups. As the productivity gains from variety go up, the level of individual output also increases. Therefore, the benefits from more ethnic fragmentation are increasing with the level of per capita output. Nonetheless, these results are empirically plausible because the benefits of skill differentiation are expected to be more relevant in more advanced and complex societies.

Moreover, the same theoretical structure can be used to examine the optimal number of jurisdictions (Alesina and Spolaore, 1997, 2003). In other words, it can be said

that the optimal number of jurisdictions based on the trade of between the costs of heterogeneity and benefits of variety. The larger the effect of variety in production and the lower the utility costs of heterogeneity, the larger the size of jurisdiction chosen by the social planner. Based on this statement, could it be expected that the production will be higher in more diverse countries? The answer highly relies on the international trade structure of the country. Under the severe trade restrictions, the size of a country would be very important for productivity. On the other hand, the small country with free trade might experience the advantages of diversity in production by means of international trade, while enjoying the benefits of homogeneity in public goods. This implies that, the effects of the size of countries on economic success are refereed by the extent of freedom of trade. This implication is also supported by several researches like Katzenstein(1985), Rogowski (1987), Ades and Glaeser (1995), Spolaore and Wacziarg (2000), and Alcala and Cicone (2004).

To sum up the ideas, we can say that the costs of diversity derive from the inability to agree on common public goods and public policies. On the other hand, the benefits of heterogeneity originate from the variety in the production. these benefits are more probably to be relevant for more advanced and complex societies. Where as in poor economies the there might not be a benefits of diversity in production. In addition, if the different groups are more unwilling to share public sources or goods, the size of jurisdictions will be smaller.

However, the model has some shortcomings. The model does not address the possible benefits of information diffusion and enforcement of contracts related to ethnic diversity. Those are very important variables especially in the context of analyzing the

developing countries. Second, the model does not explain the relationship between the political institutions and the diversity. Collier (2000, 2001) discuss that ethnic fragmentation is less disruptive in democracies because of the fact that minorities feel represented. Likewise, Alesina and Glaeser(2004) argue the same issue in the context of United States. Third missing point of the model is that while pure public goods may be decrease in more diverse communities, the amount of publicly provided private goods might be larger. For this reason, we might experience with the positive correlation between the fragmentation and ethnically based support. If you look for more evidence you can examine Alesina, et al. (2000). Finally, the model shows that increase in the diversity leads to smaller jurisdictions. However, in practice, this might cause to violent civil wars. For the reference, the researches done by Fearon and Laitin (2003), and Fearon (2002) can be a good source.

### *2.2.3 Economic Impacts of Diversity*

The literature reveals that diversity has different effects on the economic performance depending on the level of the society. Therefore, we will discuss the consequences of fragmentation starting from the most aggregate level (countries) and move down to micro levels (local jurisdictions).

#### 2.2.3.1. Countries

The very first research about the effects of fragmentation on countries is done by Easterly and Levine (1997). They discussed that the more the racially fragmented country, the less will be the growth. They used this fact to explain the Africa's poor economic

performance. In the paper, they used ethno-linguistic fractionalization measure which is a Herfindahl-based index. The index is defined as follow:

$$ELF = 1 - \sum_i s_i^2$$

where $s_i$ is the share of group i over the population. The index stands for the probability that two randomly drawn individuals from the population belong to different ethnic groups. The source of index was Atlas Narodov Mira, originally compiled by Soviet researchers. However, those results were questioned by several other researches such as Arcand, et al. (2000). Furthermore, Alesina and La Ferrara (2005) use the more updated data in order to test the negative correlation between ethnic fragmentation and growth holds irrespective of the level of economics development. They show that fractionalization has more negative impacts at lower levels of income. They also verify the results of Collier (2000) that fractionalization has negative effect on productivity and growth only in non democratic regimes, where as democracies manage to deal with diversity.

On the other hand, Easterly (2001) investigates the relationship with democracy and he constructs an index of institutional quality based on the Kanck and Keefer's (1995) data. He finds that the negative impact of ethnic diversity is significantly reduced by the presence of good institutions and the marginal effect of ethnic diversity at the maximum level of institutional development is actually zero.

In terms of the relationship between the ethnic heterogeneity and public goods, La Porta, et al. (1999) and Alesina et al. (2003) reveal that ethnic fragmentation is negatively correlated with the measures of infrastructure quality, literacy and school attainment. Yet, it is positively correlated with infant mortality. In addition, Alesina et al.

(2001) demonstrate an inverse relationship between the size of government social spending and transfers relative to GDP on the one hand, and ethnic fractionalization on the other.

2.2.3.2. Cities

The American localities are good source in order to study the impacts of ethnic fragmentation, because of the availability of data. Glaeser, et al. (1995) used the same structure of cross-country growth regressions in order to examine the growth of U.S. cities. They show that the best measure of growth to use in this case is population growth because the high mobility of individuals provides that population growth is the correct measure to use to capture areas and cities that are becoming increasingly more attractive economically and as a place to live in. Blanchard and Katz (1992) also noted that migration within the United States responds relatively quickly to income opportunities. Glaeser, et al. (1995) find that population growth is positively correlated with racial segregation in cities with large non-white communities. On the other hand, Bappaport (1999) shows that more racially fragmented counties grow less in terms of population. In their research, Alesina and La Ferrara (2005) follow the previous researches and find no effect of fractionalization on population growth. They also find consistent results with the cross-country analysis that fractionalization has negative effect on population growth in initially poor counties and a less negative effect for initially rich counties.

The productivity enhancing effects of diversity in American cities are investigated by two recent papers. Ottaviano and Peri (2003) using the wage and rent data of U.S. cities, find that U.S. born individuals who live in more culturally diverse cities pay higher rents than those living in more homogenous cities. Along the similar line, Florida (2002a,

2002b) shows that amenities and diversity in U.S. cities attract human capital. He construct a measure of heterogeneity not directly related to diversity but includes proportions of gay households, diversity of night life, etc., and finds that places that score higher in these indices are the ones who has higher human capital. In their subsequent work, Ottaviano and Peri (2004) reveal that wage of white individuals are higher in more diverse cities, after controlling for various other determinants. They measure the diversity based on main language spoken at home.

#### 2.2.3.3. Villages: Examples from Africa

When we look into literature, we can hardly find direct empirical evidences for the impacts of diversity on economic performance of local communities. However, recent studies, mainly about the Africa, allow us to draw preliminary results about the impact of diversity on productivity and economic performance.

Bigsten, et al. (2000) used a data of textile, wood food, and metal industries in Kenya to factors that affect the economic efficiency. They report that communities and kinship ties among entrepreneurs of Asian origin decrease the barriers to entry in formal sector so that African firms are much likely to be informal at start-up, even after controlling the educational differences. On the other hand, Fafchamps(2000) examines on the ethnicity and access to credits in Zimbabwe and Kenya. After controlling the firm characteristics, he shows that African firms are not discriminated against the credit access. The relationship between credit availability and productivity is further investigated by Fisman (1999, 2003). Different from the previous results, he finds that European and Asian origin companies can more easily get superior credits and companies who do not

have access to superior credits more likely face with inventory shortages, and experience low rate of capacity utilization.

Later, Fafchamps(2004) reviews his work, and broaden his analysis about the impact of ethnic diversity on economic performance and credit access. He reports two impacts. First, ethnically based networks can offer insurance, facilitate transactions, increase trust, and provide substitution for market institutions. Second result, however, reveals that the same networks may create bias against various groups. To sum up the findings, Alesina and La Ferrara (2005) show that for a given level of credit supply, as the number of ethnic groups in community increases, the chance of efficient allocation of credits decreases if the criterion is purely ethnic affiliation, which can harm the economic productivity in the end.

In the context of ethnic diversity and economic performance, La Ferrara (2002b) finds that ethnicity matters in the access of group resources, particularly in cheap credits. She shows that if the members share the same ethnicity with the chairperson, they have 20 to 25 percent more chance to borrow from the group or from the other members. The results also reveal that members of more heterogeneous groups tend to do same job instead of specializing in different tasks. In another research, by using a data of Peruvian micro finance organizations, Karlan (2003) finds that members of more homogeneous groups are more likely to save and to repay their loans. These findings confirm the fact that monitoring and enforcement within groups are easier as the social affinity among the group members increases.

While examining the relationship between the ethnic diversity and agricultural production, Macours (2003) finds that informal enforcement of property rights in the land

market produces incentives for rental transactions to remain within the group. However, this fact leads to the exclusion of minority groups and creates ethnic conflict.

In terms of effects of diversity on public policies in developing countries, the researches reveal interesting results. By using a micro level data from Indonesia, Okten and Okonkwo-Osli (2004) suggest three impacts of ethnic diversity on community organizations. First, as the diversity increases in the community, it becomes difficult to determine a common policy because of divergent preferences. Second, transaction costs increase in diverge communities, and thirdly, they show that an altruistic orientation of member to contribute to his/her own ethnic group. Brender (2004) finds the same results by using the data from Israel.

Miguel and Gugerty (2004) show the negative correlation between the diversity and school funding and quality of school facilities. According to their findings, moving from purely homogenous to purely heterogeneous would decrease the average local funding by approximately 20 percent. In her research, Abigail Barr (2003) tries to explain the reason behind the failures of collective movement in heterogeneous groups. By using the data from Zimbabwe, she suggests that the lower propensity to trust of resttled villagers is not because of differences in altruism or in social transmitted norms, rather of the lower density of kinship ties.

### *2.2.4 Problems in the Empirical Evidences*

As we present, diversity and its impacts on economic performance have been examined from different perspectives. Nevertheless, there are still some problems, needed to be addressed in order to strengthen the empirical evidences. Alesina and La Ferrara (2005) determine the two aggregate open questions for further research in the

area of ethnic diversity and its impacts on economy. The first one is endogeneity of ethnic diversity, and the second is how diversity should be measured.

#### 2.2.4.1 Endogeneity of Diversity

In all the works we present above conclude their results based on the assumption that ethnic groups are objective categories, in which individuals can be classified. They also assume that those classifications are commonly shared and exogenous. But this is not necessary to be true. First of all, people might not have the same opinion about what are the relevant ethnic groups into which they are supposed to classify others. Second, even under the most conventional definition, the cultural category might not be determined without taking the economic and policy choices into consideration at a given point. So, how can we define the ethnicity?

First, individuals' ability to classify others into ethnic groups in a correct manner can not be taken granted. Horowitz (2001) and Humpreys, et al. (2002) show the evidence from the case studies from Sr Lanka, Ethiopia, and Burundi that the possibility of faking one's accent or dress in a particular way makes it impossible to define people's ethnic origin. In another research, Habyarimana, et al. (2004) worked with the undergraduate students in United States comes from seven different ethnic group. They reported that the subjects managed to pass as members of other groups approximately 45 percent of the time.

Second, people's choice of their own ethnic identity might be responsive to the economic environment. Bloch and Rao (2001) demonstrate that, in the societies where the minorities suffer from statistical discrimination, social assimilation can occur in a way that minority members start to imitate the behavior of dominant group to signal high

productivity to potential employers. Laitin (1998) also show the same conclusion. Laitin reports that, as countries get richer, there might be a tendency for lower income ethnic groups to mimic and assimilate with higher income groups.

Third, individuals' socioeconomic background plays an important role in the determination of his or her ethnic origin. Bannon, et al. (2004) show how the socioeconomic background influence the one's own ethnic identification.

Finally, the researchers face with the endogeneity problem in the definition of ethnic diversity on account of the mobility. Changes over time in the economic growth of different metropolitan areas have induced massive flows of migration that have possibly changed the ethnic composition of the cities. Alesina, et al. (2004) conduct an empirical research, and find that endogeneity of ethnic differences due to geographic mobility is less likely to be relevant. It only matters if the ethnic differences occur as a result of diasporas following civil wars.

Although the endogeneity problem has become very popular among social scientist, there is not a great deal of research done about it. Caselli and Coleman (2002) try to formulize this problem in their work. The identification of ethnic groups is a very important issue. However, it is not a big deal all the time. In some cases ethnic or cultural differences does not matter. Why is that? Posner (2004b) try to explain this fact. According to his results, there is nothing intrinsic to physical differences or to the content of cultural traditions that should make a given ethnic divide leading or not; rather, it is the structure of domestic political and economic competition that determines political ethnic divisions into meaningful realities.

2.2.4.1 Measuring Ethnic Diversity

Although Census Bureau provides a broadly accepted classification for five major groups, the method of classification of ethnic diversity is still a difficult and politically charged issue for the other countries. Alesina et al.(2003) define language groups in addition to ethnic groups which are determined by other characteristics like skin color. They show that the correlation between the more comprehensive ELF index and the index based on language is around 0.6 and 0.7, depending on the sample. In the determination of ethnic groups, which index to use is also an important question to be addressed. Most of the literature uses an index which captures the probability that two individuals randomly drawn from the population belong to different groups, and reaches a theoretical maximum of 1 if every individual comes from different groups. The measure implies that the greater the number of ethnic groups, the more the country fractionized. However, this implication does not hold all the time. There is a high possibility that a country composed of many small groups might actually be more stable than a country composed by two equally sized ones, which are possibly to be in direct conflict with each other. Based on this argument, Estaban and Ray (1994), Montalvo and Reynal-Querol (2002) suggest the following polarization index:

$$RQ = 1 - \sum_{i=1}^{n} \left( \frac{1/2 - S_i}{1/2} \right)^2 s_i$$

where $s_i$ is the share of group *i* in the population. The index reaches maximum when two equally sized groups face each other and decreases as the configuration of groups differs more and more from this half and half split. They also show that the index is highly correlated with ethno-linguistic fractionalization at low level, uncorrelated at intermediate

levels, and negatively correlated at high levels. In their cross country analysis, they come up with the results in which they show that ethnic polarization has a positive effect on the probability of occurrence of civil war, where as a negative impact on a country's growth rate.

## *2.3 Economic Growth Models*

### *2.3.1 Solow Swan Growth Model:*

Solow-Swan start their analysis with a simple production function where there are only two inputs- physical capital K(t), and labor, L(t):

$$Y(t) = F(K(t), L(t), t) \qquad (1)$$

where Y(t) is the flow of output produced at time t. As you can see the production function depends on time, which enables us to reflect the effects of technological progress. However, for the simplicity,we will neglect he technological. In the analysis, it is assumed that output is a homogenous good that can either be consumed, C(t), or invested, I(t), to create new units of physical capital, K(t). In the model, they assumed that the economy is closed. Households can not buy foreign goods or assets and can not sell home goods or assets abroad. The natural consequence of this assumption is that output equals income, and the amount invested equals the amount saved. If s(.) is the fraction of output that is saved, or in other words that is the saving rate, 1-s(.) becomes the fraction of output that is consumed. In their analysis, Solow(1956) and Swan(1956) assume that s(.) is constant, and positive (s(.)>0). They also assume that the capital depreciates at the constant rate, which implies that, at each point in time a constant fraction of the capital stock wears out and thus, can not be used for production again.

Based on these assumptions, the net increase in the stock of physical capital at a point in time equals gross investment less depreciation:

$$\dot{K} = I - \delta K = s.F(K, L, t) - \delta K \qquad (2)$$

where $\dot{K}$ denotes for the change in the stock of physical capital. Equation 2 shows the dynamics of K for a given labor force and technology. As we mentioned before, we neglect the technological progress for simplicity; that is, F(.) is independent of t.

On the other hand, labor force changes over time due to the population growth, variation in participation rates, and shifts in the amount of time worked by a typical worker. To simplify, it is assumed that population grows at a constant rate, $\dot{L}/L = n \geq 0$

2.3.1.1 Neoclassical Production Function

When the technological progress is neglected, the equation 1 becomes:

$$Y=F(K,L)$$

We can call the production function is neoclassical if the following three properties are satisfied. First, for all K>0, and L>0, F(.) has positive and diminishing marginal products with respect to each input. Second, F(.) has constant returns to scale. Last, the marginal product of labor (capital) approaches 0 as labor(capital) goes to infinity and approaches to infinity as labor (capital)goes to 0.

Based on the second assumption, the output function can be rewritten as

$$Y = F(K,L) = L.F(K/L,1) = L.f(k) \qquad (3)$$

where k=K/L is the capital-labor ratio, y=Y/L is per capita output, and the function f(k) is equal to F(k,1).

2.3.1.2 Growth Model

After the introduction of the basic framework and the production function, We can discuss the Solow-Swan growth model. In equation 2, the change in the capital stock over time is introduced. If both side of the equation 2 is the divided by L,we have

$$\dot{K} / L = s.f(k) - \delta k \qquad (4)$$

the right hand side has per capita variables, but the left hand side does not. We can write the $\dot{K}$ as a function of k, and make both have per capita variables.

$$\dot{k} = \frac{d(K/L)}{dt} = \dot{K} / L - nk \qquad (5)$$

where $n = \dot{L} / L$. Then, we can substitute it with the equation 4, and when we rearrange the variables we get

$$\dot{k} = s.f(k) - (n + \delta)k \qquad (6)$$

This equation is the fundamental differential equation of the Solow-Swan model. This nonlinear equation depends on k. The first part of the equation has a production function, $f(k)$, and the saving rate,s(.). It looks like a positive fraction of the production function. It starts with origin and has a positive slope (because $f'(k) > 0$). The second part is a positively sloped straight line from the origin.

When we divide the both side of the equation 6, we have the growth rate of k, which is given by

$$\gamma_k = s.f(k)/k - (n + \delta) \qquad (7)$$

2.3.1.3 Steady State

Steady State is defined as a situation in which the various quantities grow at constant rates. In the Solow-Swan model, the steady state occurs when $\dot{k} = 0$ in equation 6. In other words, it occurs where

$$s.f(k^*) = (n + \delta)k^* \qquad (8)$$

As k is constant in steady state, y and c are also constant at steady state. Therefore, in steady state k,y and c does not grow in the steady state. The constant per capita magnitudes imply that the levels of variables-Y,K and C- growth at the rate of population growth, n, at steady state.

2.3.1.4 Technological Progress

In previous parts, we neglected the technological progress, which enabled us to show that all per capita variables were constant in the long run. But, it is an unrealistic assumption that the level of technology remains constant over the time. In the absence of technological growth, it will be impossible for the developed countries to maintain per capita growth for so long just by accumulating more capital per worker because of the diminishing returns. Thus, the technological progress should be included in the growth models. Nonetheless, it is an issue how to introduce exogenous technological progress into model. It might occur in several forms. The inventions might enable the producers to use either less capital input or less labor input to produce same amount of product. These are called capital-saving and labor-saving technological progress, respectively. Inventions might also do not save either input. In this case, it is called as neutral, or unbiased. Therefore, the definition of neutral technological progress relies on the precise meaning of labor saving and capital saving. On this issue, there are three well known definition in the literature.

First definition was developed by Hicks (1932). He states that a technological innovation is neutral if the ratio of marginal products stays unchanged for a given capital/labor ratio. The Hicks-neutral production function can be written as

$$Y = F(K, L) = T(t).F(K, L) \qquad (9)$$

where $T(t)$ is an index of the state of the technology, and $T(t) \geq 0$.

Second definition is belonged to Harrod (1942). He says that an innovation is neutral if the relative input shares , $K.F_K / L.F_L$ , remain constant for a given capital/labor ratio. Robinson (1938) and Uzawa(1961) write the production function implies this definition as

$$Y = F[K, L.A(t)] \qquad (10)$$

where $A(t)$ is an index of the technology, and $A(t) \geq 0$. This form is called labor augmenting technological progress since it raises output in the same way as an increase in the stock of labor.

Third one is developed by Solow(1969), and he defines as neutral if the relative input shares , $L.F_L = K.F_K$ , remain unchanged for a given labor/output ratio. The production function takes form as

$$Y = F[K.B(t), L] \qquad (11)$$

where $B(t)$ is an index of technology, and positive( $B(t) \geq 0$ ).

In our neoclassical growth model analysis, let's consider only constant rates of technological progress. Then, the labor-augmenting technological progress becomes consistent with the existence of a steady state. . Therefore, we are going to use the labor augmented approach while including the technological progress into the neoclassical growth model. Otherwise, when you try to employ approaches other than labor augmenting, you will not only deal with a very complicated models, but also will be deal with models that lack steady state, that is, in which the various growth rates do not approach constants in the long run .

2.3.1.5 Solow-Swan Growth Model with Technological Progress

We assume that the production function has labor-augmenting technological progress. Based on this assumption, we can write the equation for the change in capital stock as

$$\dot{K} = s.F(K, L.A(t)) - \delta K \qquad (12)$$

and the expression for the change in k over time can be derived by dividing both side of the equation 12 by L

$$\dot{k} = s.F[k, A(t)] - (n + \delta)k \qquad (13)$$

The only difference between the new equation and Equation 6 is that output per person now depends on the level of technology. When we divide the both side of the Equation 13 by k, we will have the growth rate:

$$\gamma_{\hat{k}} = s.F[k, A(t)]/k - (n + \delta) \qquad (14)$$

Like equation 7, $\gamma_k$ equals the difference between the two terms, first is the product of s and the average product of capital, and the second is $n + \delta$. But, the new equation differs from the equation in a way that, for given k, the average product of capital, $F[k, A(t)]/k$ increases over time dues to the growth in *A(t)* at the rate x.

In steady state, by definition, the growth rate, $\gamma_k^*$, is constant. As s, n, and δ are also constants, equation 14 implies that the average product of capital is constant in steady state. Due to the constant returns to scale, the expression for the average product equals $F[1, A(t)/k]$ and is hence constant only if k and *A(t)* grow at the same rate, which is, $\gamma_k^* = x$. We can write the output per capita as

$$y = F[k, A(t)] = k.F[1, A(t)/k] \qquad (15)$$

Since k and *A(t)* grow at the rate x in steady state, the steady state growth rate of y equals x.

In order to analyze the transitional dynamics of the model with technological progress, it will be convenient to rephrase the model in terms of variables that remain constant in the steady state. As k and *A(t)* grow at the same rate in steady state, we can use the ratio $\hat{k} = k / A(t) = K / [L.A(t)]$. The term $L.A(t) = \hat{L}$ is called as the effective amount of labor. Then, the variable $\hat{k}$ refers to the quantity of capital per unit of effective labor. The quantity of output per unit of effective labor, $\hat{y} = Y / L.A(t)$, can be written as

$$\hat{y} = F(\hat{k},1) = f(\hat{k}) \qquad (16)$$

Thus, we can rewrite the production function in intensive form when we replace y and k with $\hat{y}$ and $\hat{k}$, respectively. If we repeat the exercise that we did above, we can get the dynamic equation for $\hat{k}$:

$$\gamma_{\hat{k}} = s.f(\hat{k})/\hat{k} - (x + n + \delta) \qquad (17)$$

The only difference between the equation 7 and 17, apart from the hats (^), is the last part on the right-hand side includes the parameter x. The term $x + n + \delta$ is now the effective depreciation rate for $\hat{k}$. The steady state growth rate occurs, where $\hat{k}$ is equal to zero. We can write the steady state condition as

$$s.f(\hat{k}^*) = (x + n + \delta).\hat{k}^* \qquad (18)$$

As it can be seen the transitional dynamics of $\hat{k}$ are very similar to those of k in the previous part.

*2.3.2 Immigration in Solow-Swan Model:*

Having discussed the simple Solow-Swan growth model, we would like to introduce the migration into the Solow-Swan model. In this model, the migration is allowed; however, economy is still closed with respect to foreign goods and assets.

Let M(t) be the flow of migrants into the host economics and κ(t) the quantity of capital that each migrant brings to economy. As we discussed above, the domestic population and labor force grow at the constant rate of n. When we allow the immigration, the overall growth rate of domestic population is going to be:

$$\dot{L} / L = n + M / L = n + m \qquad (19)$$

where m=M/L is the net migration rate.

The change in net capital, on the other hand, is going to be:

$$\dot{K} = s.F(K, \hat{L}) - \delta K + \kappa M \qquad (20)$$

In the equation, the new element is, $\kappa M$ ,that is the capital moved with migrants, either brought in or taken by. Thus, we can rewrite the growth rate of capital per effective worker based on equation 19 and 20 as:

$$\gamma_{\hat{k}} = s.f(\hat{k}) / \hat{k} - (x + n + \delta) - m[1 - (\hat{\kappa} / \hat{k})] \quad (21)$$

Remember that $(x + n + \delta)$ is the effective depreciation rate for capital in the models without the migration that is the rate of decline in $\hat{k}$ due to growth of effective labor at the rate *n* and to depreciation of capital stock at the rate δ. Now, this depreciation rate is enlarged by a migration term. In term m represents the net migration rate, and if it is positive, it shows immigration into the economy. The effect of the immigration, however, depends on the terms in the brackets. Generally $\hat{\kappa} < \hat{k}$ , since the immigrants brings little physical capital. In order to explain the impacts of immigration on growth

equation better, let's discuss the two extreme cases, If those two terms are equal ($\hat{\kappa} = \hat{k}$), which means the capital brought by the immigrant is equal to the capital per unit of effective labor in the host country, then the immigration does not have any impact on the growth, and the model will be the same as the models without migration. Second, if the immigrants come with no capital $\hat{\kappa} = 0$, then the immigration adds one to one to natural population growth rate, *n*. In other words, we can perceive the immigrants like the newborns since they do not bring any accumulated capital.

2.3.2.1 Migration Function

Before the discussion of steady state, we would like to talk shortly about the migration function. For a given conditions in other economies, a higher value of $\hat{k}$ increases the domestic wage rate and, thus tends to raise the net migration rate. When we plot the net migration rate versus $\hat{k}$, we will have positively sloped curve. While driving a positive relationship between $\hat{k}$ and m, it is assumed that the conditions that affect wage rates per unit of effective labor in other economies does not change as $\hat{k}$ changes. We also hold any domestic or foreign amenities that enter into households' utility functions constant. On the other hand, the slope of the migration function depends, among other things, on the relation between the volume of migration and the cost of moving. As the cost increases rapidly with the number of migrants, then a change in $\hat{k}$ has only a small effect on migration. This implies that the migration function, $m(\hat{k})$, is flat.

We can rewrite the migration term that takes place on the right hand side of the equation 21 as

$$\xi(\hat{k}) = m(\hat{k})[1 - (\hat{\kappa} / \hat{k})], \qquad (22)$$

then, the growth model in equation 21 becomes:

$$\gamma_k = s.f(\hat{k})/\hat{k} - [x + n + \delta + \xi(\hat{k})] \quad (23)$$

The effective depreciation rate, $x + n + \delta + \xi(\hat{k})$ , includes the equation 22, $\xi(\hat{k})$ ,one to one. The $m(\hat{k})$ part of the equation 22 adds to the growth rate of effective labor and thereby to x+n. The $-m(\hat{k})(\hat{\kappa}/\hat{k})$ part of the equation 22 is represents the negative of the effect of the migrants' human captal on the growth rate of domestic capital stock. This inflow of human capital subtracts from the effective depreciation rate

2.3.2.2 The Steady-State

When we plot the equation 23, we have a downward-sloping curve for the $s.f(\hat{k})/\hat{k}$ term because of the diminishing average product of capital. However, the second part, $x + n + \delta + \xi(\hat{k})$, is not a horizontal line anymore as it was in the previous part. It is an upward sloping because of the additional term $\xi(\hat{k})$. If $\hat{k} = \tilde{k}$ , then $m(\hat{k})$ =0 ,and $\xi(\hat{k})$ =0. Thus, the height of the effective-depreciation curve at $\tilde{k}$ is $x + n + \delta$. If $\hat{k} > \tilde{k}$ , then $m(\hat{k})$>0, and the effective depreciation curve lies above the $x + n + \delta$. On the contrary, if $\hat{k} < \tilde{k}$ , the effective depreciation curve lies below the $x + n + \delta$. The steady state ( $\hat{k}^*$ ) occurs at the point where $s.f(\hat{k})/\hat{k}$ curve intersect with $[x + n + \delta + \xi(\hat{k})]$ curve.

In this section, we present the Solow-Swan Growth model. The neoclassical growth model of Solow-Swan explains the growth rate by using saving rate, population growth rate, technological progress, and the depreciation rate on the capital intensity. The model also takes immigration into consideration. But, the model does not consider the

possible impacts of diversity, which we discuss in the previous section. In this paper will examine the possible impacts of the diversity on the economic growth.

# CHAPTER 3 – EMPIRICAL RESULTS

## *3.1 Data*

In this analysis, we use the dataset from 48 state of U.S. from 1880 to 2004.The dataset is constructed by using two different sources. The first source is Easterlin (1968) database, which covers the time period of 1880 to 1950. The data is collected in every 10 years. The second source is U.S. Census database. It covers the time period of 1930 to 2004. Similar to the Easterlin database, the data is collected for every 10 years. Both datasets have the per capita income values, total population values and the aggregate foreign born population for each state. In addition, for some years, we have more detailed data for foreign born population. Instead of aggregate foreign born population, the dataset have the population values belong to different source countries for each state. For example, the number of German-born population in New York in 1960. For these years, we calculated the aggregate foreign born population by adding up these values.

In the analysis, we calculate the per capita income growth per decade of each state using the data. We also calculate the initial level of diversity of each state for each decade. We use two different measures for the diversity. First one is the percentage of foreign born, which is calculated by dividing the total number of foreign born in state *i* to total population in state *i* for a given year. The second one is the diversity index, which is taken from the literature. The diversity index is defined as

$$\text{Diversity Index} = 1 - \sum \left( \frac{\#\text{ of People Born from Source Country}_i \text{ in State}_j}{\text{Total \# of Foreign Born in State}_j} \right)^2$$

In the formula, the numerator shows the foreign born population, from source county *i,* lives in state *j*, and the denominator shows the total foreign born population in state *j* .The index means that the diversity increases as the index approaches to 1, and the diversity decreases as the index approaches to 0. The first measure shows the proportion of foreign born population in a given state, on the other hand, the second measure the variety in the foreign born population. Both measures are used for the robustness purposes. Table 1 presents the descriptive statistics for each state from 1880 to 2004.We would like to present some properties of the data by discussing three states, New York, California and Georgia.

From 1880 to 2004, the average growth of New York is 21.7 percent with the standard deviation of 0.15. On the other hand, Georgia has higher growth rate with a higher deviation for the same time period. The growth rate is 41.4% and the standard deviation is 0.32. Similar to New York, California has lower growth rate with less deviation. California has 17.5% average per capita growth rate, with the standard deviation of 0.09 from 1880 to 2004. When we look into the percentage of foreign born population in those three states, we notice that New York and California has similar numbers. On the average, the percentage of foreign born population is 19.7% in New York, and 18.5% in California between 1880 and 2004. For the same time period, the data indicates that Georgia has the lowest average foreign born percentage, which is 1.22%. However, Georgia experiences the highest diversity value, which is 0.89, among those three states. These values indicate that although the percentage of foreign born population is very small in Georgia over the time period of 1880 to 2004, the states has a

very diverse foreign born population. For California and New York, the diversity values are 0.87, and 0.83, respectively.

**Table 1 Descriptive Statistics (1880-2003)**

| ***Alabama*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
|---|---|---|---|
| Mean | 0.398790772 | 0.772727273 | 0.883070787 |
| Median | 0.277430689 | 0.8 | 0.920382058 |
| Min | 0.062960351 | 0.4 | 0.65694217 |
| Max | 0.919580736 | 1.6 | 0.954476031 |
| Std Dev | 0.275091983 | 0.360807176 | 0.102583361 |
| ***Arizona*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.184579841 | 13.53636364 | 0.62461253 |
| Median | 0.161471219 | 7.8 | 0.63823215 |
| Min | -0.052249637 | 4.3 | 0.399664441 |
| Max | 0.60417328 | 39.7 | 0.775592958 |
| Std Dev | 0.197383651 | 10.79715451 | 0.123156963 |
| ***Arkansas*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.409132942 | 0.854545455 | 0.836857268 |
| Median | 0.335952045 | 0.8 | 0.884798879 |
| Min | 0.066315475 | 0.4 | 0.52125455 |
| Max | 0.956203658 | 1.8 | 0.95267826 |
| Std Dev | 0.265808146 | 0.45246798 | 0.147451636 |
| ***California*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.174591909 | 18.45454545 | 0.86954222 |
| Median | 0.165696214 | 18.9 | 0.920414677 |
| Min | -0.019671472 | 8.5 | 0.670548342 |
| Max | 0.313877977 | 33.9 | 0.928884208 |
| Std Dev | 0.094440485 | 8.109298815 | 0.094402425 |
| ***Colorado*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.215409266 | 8.618181818 | 0.887253761 |
| Median | 0.23843418 | 6.4 | 0.922370103 |
| Min | -0.017855077 | 2.7 | 0.678350611 |
| Max | 0.654022935 | 20.5 | 0.94627537 |
| Std Dev | 0.195615089 | 5.941518018 | 0.093107354 |
| ***Connecticut*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.249825364 | 16.16363636 | 0.855349093 |
| Median | 0.212563939 | 14.8 | 0.887821059 |
| Min | -0.005571222 | 8.5 | 0.720494981 |
| Max | 0.631805158 | 27.4 | 0.941683777 |
| Std Dev | 0.163897072 | 7.599509554 | 0.077108289 |
| ***Delaware*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.288112116 | 5.190909091 | 0.8743011 |
| Median | 0.245379862 | 4.7 | 0.890754179 |
| Min | 0.05577109 | 2.9 | 0.71243559 |
| Max | 0.996810207 | 8.9 | 0.985939857 |
| Std Dev | 0.26761641 | 2.059346763 | 0.091518573 |
| ***Florida*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.398789007 | 7.554545455 | 0.805269733 |
| Median | 0.331814661 | 5.5 | 0.886350909 |
| Min | 0.002715287 | 3.7 | 0.622797087 |

**Table 1 Descriptive Statistics - Continue**

| | | | |
|---|---|---|---|
| Max | 0.925064599 | 18.4 | 0.936399301 |
| Std Dev | 0.285215855 | 4.663553074 | 0.139633856 |
| ***Georgia*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.414724768 | 1.218181818 | 0.887066167 |
| Median | 0.313390914 | 0.6 | 0.911893599 |
| Min | -0.024243446 | 0.4 | 0.719534491 |
| Max | 0.941558442 | 4.4 | 0.954321142 |
| Std Dev | 0.320025397 | 1.26239311 | 0.080518842 |
| ***Idaho*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.225924876 | 7.763636364 | 0.850901707 |
| Median | 0.153652868 | 4.7 | 0.909745934 |
| Min | -0.072164948 | 1.8 | 0.573458137 |
| Max | 0.711196514 | 30.6 | 0.927267244 |
| Std Dev | 0.228292783 | 8.549651774 | 0.130929442 |
| ***Illinois*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.262279041 | 12.09090909 | 0.870073017 |
| Median | 0.204676578 | 9.5 | 0.915152305 |
| Min | -0.030035585 | 5.7 | 0.675672918 |
| Max | 0.524523161 | 20.1 | 0.925619495 |
| Std Dev | 0.175801279 | 5.441590677 | 0.09044243 |
| ***Indiana*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.323402156 | 3.436363636 | 0.854805553 |
| Median | 0.277593085 | 2.5 | 0.914017256 |
| Min | 0.008017423 | 1.6 | 0.640472605 |
| Max | 0.817475728 | 7.3 | 0.956411655 |
| Std Dev | 0.234941056 | 1.909593008 | 0.126463255 |
| ***Iowa*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.311027616 | 5.845454545 | 0.803704807 |
| Median | 0.170127999 | 3.9 | 0.869939081 |
| Min | 0.045907626 | 1.4 | 0.36817696 |
| Max | 0.841000903 | 16.1 | 0.95684184 |
| Std Dev | 0.270017208 | 5.131542387 | 0.197498774 |
| ***Kansas*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.367357173 | 4.372727273 | 0.845098927 |
| Median | 0.223050237 | 2.9 | 0.903632104 |
| Min | 0.011090516 | 1.2 | 0.519233258 |
| Max | 1.058086742 | 11.1 | 0.918695999 |
| Std Dev | 0.332759927 | 3.222759969 | 0.14537904 |
| ***Kentucky*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.349776316 | 1.318181818 | 0.797469591 |
| Median | 0.324805967 | 0.9 | 0.833959826 |
| Min | 0.031543203 | 0.5 | 0.532324831 |
| Max | 0.829475186 | 3.6 | 0.950234126 |
| Std Dev | 0.229554069 | 1.027441659 | 0.14990212 |
| ***Louisiana*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.321706535 | 2.272727273 | 0.834419285 |

**Table 1 Descriptive Statistics - Continue**

| | | | |
|---|---|---|---|
| Median | 0.221781464 | 2 | 0.846285411 |
| Min | 0.086129901 | 0.9 | 0.633104802 |
| Max | 0.818112369 | 5.8 | 0.947570425 |
| Std Dev | 0.245426219 | 1.452646488 | 0.099865873 |
| ***Maine*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.273511903 | 7.890909091 | 0.685422585 |
| Median | 0.325304745 | 8.2 | 0.723902848 |
| Min | 0.069678614 | 2.2 | 0.471982139 |
| Max | 0.480620155 | 14 | 0.752267091 |
| Std Dev | 0.140385972 | 4.282862254 | 0.096903321 |
| ***Maryland*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.291233487 | 5.854545455 | 0.846571067 |
| Median | 0.300489757 | 5.9 | 0.890955912 |
| Min | 0.041182999 | 3 | 0.660406598 |
| Max | 0.54939759 | 9 | 0.964346139 |
| Std Dev | 0.167405584 | 2.206972422 | 0.110435133 |
| ***Massachusetts*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.221382301 | 17.66363636 | 0.86377353 |
| Median | 0.226650062 | 15.4 | 0.906146002 |
| Min | 0.006168287 | 8.7 | 0.67671648 |
| Max | 0.383717962 | 30.2 | 0.94408899 |
| Std Dev | 0.112568226 | 8.275901489 | 0.089620405 |
| ***Michigan*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.2892455 | 11.92727273 | 0.873331525 |
| Median | 0.233200557 | 9.5 | 0.911563834 |
| Min | -0.017328675 | 3.8 | 0.670128489 |
| Max | 0.687002653 | 23.7 | 0.94961474 |
| Std Dev | 0.213030611 | 7.721410611 | 0.095242747 |
| ***Minnesota*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.299617583 | 12.14545455 | 0.832068678 |
| Median | 0.212818766 | 7.1 | 0.876207745 |
| Min | 0.017915413 | 2.6 | 0.499807012 |
| Max | 0.637795276 | 34.3 | 0.952938262 |
| Std Dev | 0.199838012 | 11.23818167 | 0.150462934 |
| ***Mississippi*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.396434297 | 0.572727273 | 0.883872919 |
| Median | 0.269718461 | 0.5 | 0.914368204 |
| Min | 0.066508125 | 0.3 | 0.691801177 |
| Max | 1.147935003 | 0.9 | 0.951066303 |
| Std Dev | 0.308318242 | 0.2284334 | 0.087739611 |
| ***Missouri*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.298104679 | 3.754545455 | 0.827679911 |
| Median | 0.238570967 | 3 | 0.877030242 |
| Min | 0.021131884 | 1.4 | 0.557184091 |
| Max | 0.684719536 | 9.8 | 0.96217623 |
| Std Dev | 0.211732037 | 2.679687906 | 0.142325044 |

**Table 1 Descriptive Statistics – Continue**

| ***Montana*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
|---|---|---|---|
| Mean | 0.211532981 | 10.73636364 | 0.885740097 |
| Median | 0.118368028 | 7.4 | 0.912242419 |
| Min | -0.343195266 | 0.8 | 0.694734889 |
| Max | 0.742585489 | 29.4 | 0.937814352 |
| Std Dev | 0.31584183 | 10.26355423 | 0.085788591 |
| ***Nebraska*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.337873968 | 7.390909091 | 0.820091392 |
| Median | 0.157476099 | 4.4 | 0.873608421 |
| Min | 0.016954787 | 1.8 | 0.422588241 |
| Max | 1.127079207 | 21.5 | 0.947174488 |
| Std Dev | 0.358621423 | 6.617621105 | 0.180611286 |
| ***Nevada*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.151701173 | 14.35454545 | 0.863842042 |
| Median | 0.127183684 | 10 | 0.883536524 |
| Min | -0.232091691 | 3.7 | 0.636012184 |
| Max | 0.452466907 | 41.2 | 0.925408165 |
| Std Dev | 0.185264472 | 11.10273513 | 0.102944019 |
| ***New Hampshire*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.256184604 | 11.11818182 | 0.768090777 |
| Median | 0.317471691 | 10.9 | 0.774872552 |
| Min | 0.00796733 | 3.7 | 0.627634804 |
| Max | 0.370074455 | 21.4 | 0.916105849 |
| Std Dev | 0.121846943 | 6.755267305 | 0.10001771 |
| ***New Jersey*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.239118133 | 15.79090909 | 0.850284722 |
| Median | 0.272566372 | 14.9 | 0.888016121 |
| Min | -0.020913305 | 8.9 | 0.71524185 |
| Max | 0.415855355 | 23.5 | 0.944186413 |
| Std Dev | 0.125445609 | 5.300840414 | 0.080819498 |
| ***New Mexico*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.375114078 | 4.8 | 0.690164504 |
| Median | 0.284098455 | 5.3 | 0.675611177 |
| Min | 0.07533179 | 2.2 | 0.523193784 |
| Max | 0.900867299 | 8.3 | 0.891739977 |
| Std Dev | 0.26844901 | 2.118017941 | 0.12171693 |
| ***New York*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.217434759 | 19.66363636 | 0.83330329 |
| Median | 0.259184226 | 19.6 | 0.887298775 |
| Min | -0.004449226 | 11.6 | 0.647968848 |
| Max | 0.37993921 | 27.2 | 0.911060112 |
| Std Dev | 0.148062471 | 5.619835002 | 0.103446136 |
| ***North Carolina*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.460275305 | 0.936363636 | 0.87757257 |
| Median | 0.328014184 | 0.4 | 0.919520491 |
| Min | -0.018070657 | 0.2 | 0.660978436 |

**Table 1 Descriptive Statistics - Continue**

| | | | |
|---|---|---|---|
| Max | 1.150684932 | 4.4 | 0.959686858 |
| Std Dev | 0.374815519 | 1.243601807 | 0.100683738 |
| ***North Dakota*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.47305863 | 10.37 | 0.793901686 |
| Median | 0.283673766 | 6.25 | 0.835483909 |
| Min | -0.046948357 | 1.5 | 0.490279209 |
| Max | 1.489096573 | 35.4 | 0.890249583 |
| Std Dev | 0.526590979 | 10.90606865 | 0.135486527 |
| ***Ohio*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.280939139 | 6.618181818 | 0.871902708 |
| Median | 0.198040541 | 5.6 | 0.920811406 |
| Min | 0.009165784 | 2.4 | 0.680411674 |
| Max | 0.616 | 12.3 | 0.961366876 |
| Std Dev | 0.17968546 | 3.987936354 | 0.104611999 |
| ***Oklahoma*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.371141295 | 1.65 | 0.859361356 |
| Median | 0.316203118 | 1.6 | 0.906043207 |
| Min | 0.045903961 | 0.8 | 0.577319285 |
| Max | 0.922413793 | 3.2 | 0.93292891 |
| Std Dev | 0.298847085 | 0.842285251 | 0.128316052 |
| ***Oregon*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.247093315 | 8.781818182 | 0.870863126 |
| Median | 0.209141771 | 7.8 | 0.915555406 |
| Min | -0.030581702 | 3.2 | 0.635364022 |
| Max | 0.607485498 | 17.5 | 0.924927021 |
| Std Dev | 0.172023207 | 5.110150327 | 0.105375944 |
| ***Pennsylvania*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.241396353 | 8.554545455 | 0.880840973 |
| Median | 0.24279643 | 7.5 | 0.904113302 |
| Min | 0.02060195 | 2.9 | 0.713397462 |
| Max | 0.427921093 | 16 | 0.956779799 |
| Std Dev | 0.133003561 | 5.242587841 | 0.077664012 |
| ***Rhode Island*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.202144269 | 17.28181818 | 0.844238944 |
| Median | 0.217131474 | 14.4 | 0.886889301 |
| Min | 0.049382632 | 7.8 | 0.650044443 |
| Max | 0.384123164 | 31.4 | 0.907957129 |
| Std Dev | 0.100286102 | 9.293418981 | 0.089395816 |
| ***South Carolina*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.434651321 | 0.736363636 | 0.871186737 |
| Median | 0.306833648 | 0.5 | 0.903989259 |
| Min | 0.011054916 | 0.3 | 0.706855189 |
| Max | 0.953947368 | 1.6 | 0.950942903 |
| Std Dev | 0.308885552 | 0.514339824 | 0.087215556 |
| ***South Dakota*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.455945391 | 9.318181818 | 0.819100812 |

**Table 1 Descriptive Statistics - Continue**

| | | | |
|---|---|---|---|
| Median | 0.275337526 | 4.7 | 0.879696635 |
| Min | 0.090281372 | 1.1 | 0.380457521 |
| Max | 1.489096573 | 38.3 | 0.955685885 |
| Std Dev | 0.461539741 | 11.57340211 | 0.195842218 |
| ***Tennessee*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.39918467 | 0.818181818 | 0.885549791 |
| Median | 0.286699904 | 0.7 | 0.91548816 |
| Min | 0.044895782 | 0.4 | 0.706645181 |
| Max | 0.834375 | 1.8 | 0.959321944 |
| Std Dev | 0.25275742 | 0.449039379 | 0.083654644 |
| ***Texas*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.393934717 | 6.136363636 | 0.582094319 |
| Median | 0.275903306 | 6 | 0.537558942 |
| Min | -0.029920688 | 2.8 | 0.491189623 |
| Max | 0.847968545 | 12.2 | 0.760765513 |
| Std Dev | 0.28764263 | 2.857716825 | 0.095074551 |
| ***Utah*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.308545019 | 9.272727273 | 0.827197672 |
| Median | 0.216266565 | 5.5 | 0.885853184 |
| Min | 0.012631818 | 2.8 | 0.441200274 |
| Max | 0.663285398 | 30.6 | 0.946334578 |
| Std Dev | 0.227377897 | 8.732135009 | 0.174721386 |
| ***Vermont*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.265824876 | 7.927272727 | 0.753940695 |
| Median | 0.322164948 | 7.6 | 0.784924829 |
| Min | 0.072549093 | 3.1 | 0.611424112 |
| Max | 0.443180348 | 13 | 0.820344158 |
| Std Dev | 0.132956599 | 3.991263186 | 0.071045499 |
| ***Virginia*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.410954031 | 2.290909091 | 0.889998017 |
| Median | 0.446586301 | 1.2 | 0.924002561 |
| Min | 0.037141483 | 0.9 | 0.689924018 |
| Max | 0.833333333 | 7.7 | 0.96454687 |
| Std Dev | 0.240816508 | 2.200661058 | 0.093051955 |
| ***Washington*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.261523178 | 11.77272727 | 0.870285502 |
| Median | 0.205378795 | 8.3 | 0.898914432 |
| Min | 0.009466953 | 4.6 | 0.646517129 |
| Max | 0.546467902 | 21.5 | 0.933993679 |
| Std Dev | 0.171066148 | 6.607887848 | 0.099542951 |
| ***West Virginia*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.353807195 | 1.963636364 | 0.86954438 |
| Median | 0.267017494 | 1.7 | 0.902749787 |
| Min | 0.073632917 | 0.9 | 0.674852029 |
| Max | 0.89958159 | 4.2 | 0.94892701 |
| Std Dev | 0.246345873 | 1.0846868 | 0.090176318 |

**Table 1 Descriptive Statistics - Continue**

| ***Wisconsin*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
|---|---|---|---|
| Mean | 0.307193902 | 10.72727273 | 0.801273653 |
| Median | 0.207960967 | 6.3 | 0.856283787 |
| Min | 0.022904798 | 2.5 | 0.450088702 |
| Max | 0.711895911 | 30.8 | 0.946961556 |
| Std Dev | 0.219776463 | 9.80633376 | 0.165778705 |
| ***Wyoming*** | ***GDP Growth*** | ***Percentage of Foreign Born*** | ***Diversity Index*** |
| Mean | 0.237166247 | 8.363636364 | 0.890870004 |
| Median | 0.224414802 | 4.6 | 0.920595826 |
| Min | -0.021944224 | 1 | 0.67791475 |
| Max | 0.708608149 | 28.1 | 0.948690253 |
| Std Dev | 0.194127616 | 8.691866627 | 0.095958704 |

### *3.2 Initial Analysis*

As we mentioned in the introduction, the aim of this thesis is to examine the impacts of immigration in the host country in the long run using the model of the growth literature. We initiate our analysis by following the Barro (1991). The discussion starts with the introduction of Barro's methodology. Then we present the empirical findings.

#### *3.2.1 Methodology*

In neoclassical growth models, Solow (1956), Cass (1965), and Koopmans (1965), a country's per capita growth rate tends to be inversely related to its initial level of income per person., Barro(1990) tests this hypothesis by using cross country data, and he shows that growth rate of real per capita GDP is negatively related to the initial level of per capita GDP. Barro starts the analysis by looking into the relation between the per capita GDP growth and the level of initial per capita GDP by using the cross section data of countries. Initially, he finds a little correlation between the initial per capita GDP and per capita GDP growth. Then, he regress the annual average growth rates of per capita real GDP on the level of initial per capita GDP and initial human stock. He finds that negative correlation between the initial level of per capita GDP and per capita growth if measures of initial human capital are held constant. Besides, the growth rate is substantially positively related to starting amount of human capital for a given level of initial per capita GDP.

In addition, Barro and Sala-i Martin test the hypothesis that regions with a low level of income show faster subsequent growth. They find the consistent results for 48 US states. The logic behind this convergence is that regions with relatively low level of capital have a larger marginal productivity of capital, and therefore accumulate capital at a relatively fast rate.

We replicate Barro's exercise and regress per capita GDP growth on initial per capita GDP for 50 states for 10 year period. In order to control the initial per capita GDP we construct the model as

$$\text{GDPGrowth}_i = \beta_0 + \beta_1 \text{Initial GDP}_i + \varepsilon$$

Where the dependent variable is per capita GDP growth of state *i* for given time period, and explanatory variable is the initial level of per capita GDP of state *i* for the beginning of the time period.

Then, we calculate the correlation between the diversity index and percentage of foreign born, and residuals of the model. The next step for the analysis is to estimate the relationship between the diversity and per capita GDP growth by using panel data estimation methods. We introduce the panel data methodology and empirical findings in the next chapter. Now, we are going to examine the empirical findings of our analysis.

*3.2.2 Empirical Evidences*

In his research, Barro(1991) states that the growth rate of real per capita GDP is positively related to initial human capital and negatively related to initial level of real per capita GDP. We start the analysis by following the Barro's exercise in the data. First, we try to determine the relationship between the growth rate of real per capita GDP and initial level of diversity. At first, we calculate the correlations between the percentage of foreign born and per capita GDP. The first column of Table 2 shows that there is a negative relationship between the percentage of foreign born and the growth of real per capita GDP. You can find the correlation plots in Appendix. Then, we try to control for the initial level of real per capita GDP, and look for the relationship between the growth rate of real per capita GDP and percentage of foreign born. We regressed the per capita GDP growth on the initial level of the real per capita. As we expect, the results confirm the theory and they indicate the negative relationship between the initial level of income and the per capita growth for each period. You can find the regression results in Table 3.

Then, we calculate the correlations between the residuals of the regression and the percentage of foreign born population. The results do not change dramatically. The second column of Table 2 indicates that, after controlling the initial level of income, we still a negative relationship between the per capita GDP growth and percentage of foreign born. The correlation plots are presented in Appendix.

**Table 2- Correlation Table-Per Capita GDP Growth and % Foreign Born Population- 10 years**

| Period | Per capita GDP Growth & % of Foreign Born Population | Residuals & % of Foreign Born Population |
|---|---|---|
| 1880-1900 | -0.155 | 0.418 |
| 1900-1920 | -0.701 | -0.127 |
| 1920-1950 | -0.592 | -0.016 |
| 1930-1940 | -0.483 | -0.332 |
| 1940-1950 | -0.620 | -0.425 |
| 1950-1960 | -0.246 | 0.272 |
| 1960-1970 | -0.249 | 0.212 |
| 1970-1980 | -0.562 | -0.294 |
| 1980-1990 | 0.218 | 0.354 |
| 1990-2000 | -0.293 | -0.161 |
| 2000-2004 | -0.558 | -0.313 |

## Table 3 – Regression Table- Regression For Per Capita Growth -10 Years

| Dependent Variable | Gdp Growth 1880-1900 | Gdp Growth 1900-1920 | Gdp Growth 1920-1950 | Gdp Growth 1930-1940 | Gdp Growth 1940-1950 | Gdp Growth 1950-1960 | Gdp Growth 1960-1970 | Gdp Growth 1970-1980 | Gdp Growth 1980-1990 | Gdp Growth 1990-2000 | Gdp Growth 2000-2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | | | | | | | | | | | |
| Constant | 0.681602* (0.074) | 0.908544* (0.063975) | 1.075698* (0.073544) | 0.259773* (0.040936) | 0.953055* (0.101338) | 0.447449* (0.037167) | 0.707241* (0.057963) | 0.348866* (0.054400) | 0.350571* (0.088411) | 0.227064* (0.048839) | 0.156607* (0.030445) |
| GDP1880E | -0.000156* (3.31E-05) | | | | | | | | | | |
| GDP1900E | | -0.000212* (2.42E-05) | | | | | | | | | |
| GDP1920E | | | -0.000153 (2.22E-05) | | | | | | | | |
| GDP1930 | | | | -0.0000199$^{\Psi}$ (1.21E-05) | | | | | | | |
| GDP1940 | | | | | -9.19E-05* (2.55E-05) | | | | | | |
| GDP1950 | | | | | | -3.99E-05* (6.00E-06) | | | | | |
| GDP1960 | | | | | | | -4.34E-05* (7.90E-06) | | | | |
| GDP1970 | | | | | | | | -1.64E-05* (5.39E-06) | | | |
| GDP1980 | | | | | | | | | -1.17E05$^{\Psi}$ (7.43E-06) | | |
| GDP1990 | | | | | | | | | | -4.96E-06$^{\Psi}$ (3.39E-06) | |
| GDP2000 | | | | | | | | | | | -7.83E-06* (1.83E-06) |
| | | | | | | | | | | | |
| # of Observations | 48 | 48 | 48 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| $R^2$ | 0.3318 | 0.63 | 0.51 | 0.053 | 0.2 | 0.48 | 0.3866 | 0.16 | 0.0488 | 0.0426 | 0.27613 |

(*) Significant at 1% level

($^{\Psi}$) Significant at 20% level

We also want to see how the correlation numbers change when we expand the time period. We repeat the same analysis by using the 20 years time intervals in order to figure the possible differences in the results when the time period gets larger. We did same analysis on Census data starting from 1930. First, we calculate the correlation between the per capita GDP growth and percentage of foreign born population for 20 years. As the first column of Table 4 presents the per capita GDP Growth and the percentage of foreign born population is negatively correlated. You can also find the correlation plots in Appendix.

**Table 4- Correlation Table- Per Capita GDP Growth and % Foreign Born Population- 20 years**[1]

| Period | Per capita GDP Growth & % of Foreign Born Population | Residuals & % of Foreign Born Population |
|---|---|---|
| 1930-1950 | -0.666 | -0.423 |
| 1940-1960 | -0.702 | -0.021 |
| 1950-1970 | -0.420 | 0.163 |
| 1960-1980 | -0.563 | -0.135 |
| 1970-1990 | -0.092 | 0.179 |
| 1980-2000 | 0.019 | 0.215 |
| 1990-2004 | -0.576 | -0.285 |

[1] Does not include Easterlin Data

Then, we try to control for the initial level of real per capita GDP, and look for the relationship between the growth rate of real per capita GDP and percentage of foreign born. We regressed the per capita GDP growth on the initial level of the real per capita for the time period of 20 years. The results indicate that the per capita GDP Growth decreases as the percentage of foreign born population increases. The regression results are presented in Table 5.

**Table 5: Regression Table- Regression For Per Capita Growth -20 years**

| Dependent Variable | Gdp Growth 1930-1950 | Gdp Growth 1940-1960 | Gdp Growth 1950-1970 | Gdp Growth 1960-1980 | Gdp Growth 1970-1990 | Gdp Growth 1980-2000 | Gdp Growth 1990-2004 |
|---|---|---|---|---|---|---|---|
| Independent Variable | | | | | | | |
| Constant | 1.482581* (0.145106) | 1.929153* (0.063488) | 1.357061* (0.082083) | 1.189522* (0.080948) | 0.630965* (0.075438) | 0.684496* (0.121305) | 0.389416* (0.051102) |
| GDP1930 | -0.000172* (4.30E-05) | | | | | | |
| GDP1940 | | -0.000247* (1.56E-05) | | | | | |
| GDP1950 | | | -0.000111* (1.32E-05) | | | | |
| GDP1960 | | | | -7.45E-05* (1.10E-05) | | | |
| GDP1970 | | | | | -1.97E-05§ (7.47E-06) | | |
| GDP1980 | | | | | | -2.38E-05§ (1.02E-05) | |
| GDP1990 | | | | | | | -1.41E-05* (3.55E-06) |
| | | | | | | | |
| # of Observations | 50 | 48 | 50 | 50 | 50 | 50 | 50 |
| R2 | 0.250935 | 0.844549 | 0.594476 | 0.487515 | 0.126959 | 0.102208 | 0.248385 |

(*) Significant at 1% level
(§) Significant at 5% level

Lastly, we calculate the correlations between the residuals of the regression and the percentage of foreign born population. The results in the second column of Table 4 show that, having excluded the impacts of initial level of income, we still have the negative relationship between the per capita GDP Growth and percentage of foreign born.

We calculate the diversity index for 1900, 1920, 1930, 1940, 1950, 1960 and 1990 due to the limited data. In order to figure out the relationship between the diversity and economic growth, we plot the initial level diversity versus the 10 year growth rate of real per capita GDP. The results in the first column of Table 6 shows that there is a negative relationship between the diversity and growth rate for the time periods of 1900-1920, 1950-1960, 1960-1970. However, for the time periods of 1920-1950, 1930-1940, 1940-1950, and 1990-2000, the results show the positive correlation between the diversity and growth rate. The plots for the correlations between the per capita GDP growth and Diversity Index are presented in Appendix.

**Table 6- Correlation Table - Per Capita GDP Growth and Diversity Index-10 years:**

| Period | Per capita GDP Growth and Diversity Index | Residuals and Diversity Index |
|---|---|---|
| 1900-1920 | -0.144 | 0.102 |
| 1920-1950 | 0.075 | 0.197 |
| 1930-1940 | 0.165 | 0.358 |
| 1940-1950 | 0.085 | 0.039 |
| 1950-1960 | -0.072 | -0.007 |
| 1960-1970 | -0.213 | -0.224 |
| 1990-2000 | 0.224 | 0.243 |

Following the same path in the previous analysis, we plot the growth rate of real per capita GDP and diversity after controlling the initial level of real per capita GDP. We calculate the correlation between the diversity index and the residuals of the per capita GDP Growth regressions, which are presented in Table 3. The results do not change dramatically. Although the correlation sign for 1900-1920 changes from negative to positive, the correlation signs remain same for the rest of the time periods. The results are presented in the second column of the Table 6. Lastly, in this part, we expand the time period, and look for the relationship between the diversity and growth in 20 years interval. Table 7 shows that the correlation between the diversity and growth are positive, except the time period of 1930-1950. Furthermore, the sign of correlation figures does not change after we control the initial level of real per capita GDP. The related correlation plots are presented in Appendix A.

**Table 7- Correlation Table- Per Capita GDP Growth and Diversity Index -20 years:**

| Period | Correlations between per capita GDP Growth and Diversity Index | Correlation between the Residuals and Diversity Index |
|---|---|---|
| 1930-1950 | -0.349 | -0.149 |
| 1940-1960 | 0.065 | 0.0105 |
| 1950-1970 | 0.036 | 0.176 |
| 1960-1980 | 0.008 | 0.070 |
| 1990-2004 | 0.201 | 0.271 |

### *3. 3 Panel Data Estimation*

In the second step of the research, in which we try to address the impacts of immigration on economy using the growth model, we employ the panel data models. In the first part we will introduce the panel data estimation methodology. Then, we will present our empirical results, and conclude the chapter with the further suggestions.

#### *3.3.1 Methodology*

Panel data are data where multiple cases, (in this research states) were observed at two or more time periods. Cross-sectional time-series data has two kinds of information. The cross-sectional information reflected in the differences between subjects, and the time-series reflected in the changes within subjects over time. Panel data regression techniques allow you to take advantage of these different types of information. Let *i* denote the cross-sectional unit and *t* the time period, we can write a panel data model as

$$y_{it} = \beta_0 + \beta X_{it} + a_i + u_{it} \quad (1)$$

In the notation, $y_{it}$ is the dependent variable, in this research it is per capita GDP Growth per state for time period i. $\beta_0$ is intercept and $\beta X_{it}$ is the vector of explanatory variables. The $u_{it}$ is the idiosyncratic error, and it represents unobserved factors that change over time and affect $y_{it}$. These are very similar to the errors in a straight time series regression equation. The ai, on the other hand, captures all unobserved, time-constant factors that affect yit. For simplicity let assume that $v_{it}=a_i+u_{it}$, and rewrite the equation as

$$y_{it} = \beta_0 + \beta X_{it} + v_{it} \quad (2)$$

where $v_{it}$ is the composite error. From OLS estimation, $v_{it}$ should be assumed to be uncorrelated with $X_{it}$ in order to get consistent estimates for β. Even if it is assumed that the idiosyncratic error term $u_{it}$ is uncorrelated with $X_{it}$, we still can not state that OLS is unbiased and consistent because we do not know the correlation between $a_i$ and $X_{it}$. If they are correlated, the results will be biased and inconsistent. In panel data estimation, two different estimation methods are used depending on the assumption between the Xit and ai. If it is assumed that they are correlated, the fixed effects models, and if it is assumed that they are uncorrelated, the random effects models should be used.

3.3.1.1 Fixed Effects Models

In fixed model effects, it is assumed that the explanatory variables and unobserved time constant factors are correlated ( $Cov(X_{it}, a_i) \neq 0$ ). In order to explain the dynamics of the model, let's consider a model with single explanatory variable: for each *i,*

$$y_{it} = \beta_1 x_{it} + a_i + u_{it} \quad (3)$$

Now, average the equation over time, fore each *i*:

$$\bar{y}_i = \beta_1 \bar{x}_i + a_i + \bar{u}_i \quad (4)$$

Since $a_i$ is fixed over time, it appears in both equations. If we subtract the second equation from first one, we get

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{it} + \ddot{u}_{it} \quad (5)$$

In the notation, $\ddot{y}_{it} = y_{it} - \bar{y}_i$ and we call it time-demeaned data on y, and similarly for $\ddot{x}_{it}$ and $\ddot{u}_{it}$ . The fixed effects transformation is also named as within transformation. The important point about the last equation is that the unobserved effect, $a_i$, has disappeared. This implies that we estimate by pooled OLS. A pooled OLS estimator that is based on time-demeaned variables is called the fixed effects estimators. Under a strict exogeneity assumption on the explanatory variables, the fixed effects estimator is unbiased: generally, the idiosyncratic error $u_{it}$ should be uncorrelated with each explanatory variable across all time periods. The fixed effects estimators allow for arbitrary correlation between ai and the explanatory variables in any time period, but the correlation does not affect the results because it disappears with the transformation.

3.3.1.2 Random Effects Models

In random effects models, it is assumed that unobserved effect ai is uncorrelated with each explanatory variable ($Cov(X_{it}, a_i) = 0$). In order to explain the dynamics of random effects model, lets define the composite error term as $v_{it}=a_i +u_{it}$, and write the model as

$$y_{it} = \beta_0 + \beta X_{it} + v_{it} \quad (6)$$

Since $a_i$ is included in the composite error in each time period, the vit are serially correlated across time, and the correlation is equal to

$$Corr(v_{it}, v_{is}) = \sigma_a^2 / (\sigma_a^2 + \sigma_u^2), \text{t} \neq \text{s} \quad (7)$$

where $\sigma_a^2 = Var(a_i)$ and $\sigma_u^2 = Var(u_{it})$

The positive serial correlation in the error term can be substantial. In order to eliminate this problem, the generalized least squares can be used to estimate the model. However, in order for the procedure to have good properties, it mast have large N and relatively small T. Derivation of GLS transformation that eliminates serial correlation in the error terms can be written as

$$y_{it} - \bar{y}_i = \beta_0(1-\lambda) + \beta(X_{it} - \lambda\overline{X}_i) + (v_{it} - \lambda v_i) \qquad (8)$$

where $\lambda = 1 - [\sigma_u^2(\sigma_u^2 + T\sigma_a^2]^{1/2}$

In the notation, the overbar represents the time averages. While the fixed effects estimator subtracts the time averages from the corresponding variable, the random effects transformation subtracts a fraction of that time average, where the fraction depends on the variances of $a_i$ and $u_{it}$, and T.

In this research, we construct the panel data models for as

$$\dot{y}_{it} = \beta_0 + \beta_1 y_{i,t-1} + \beta_1 per\_foreign\_pop_{it} + v_{it} \qquad (9)$$

$$\dot{y}_{it} = \beta_0 + \beta_1 y_{i,t-1} + \beta_1 Diversity_{it} + v_{it} \qquad (10)$$

Where $\Delta\dot{y}_{it}$ represents the per capita GDP Growth, $y_{it-1}$ denotes initial per capita GDP and $per\_foreign\_pop_{it}$ represents percentage of foreign born. In the second model, $Diversity_{it}$ denotes for the diversity index we explained in previous section. We present the details of panel data estimation models in the next section.

#### 3.3.1.3 Hausman Test

So far we have introduced two different models in panel data estimation. The main difference between those two models depends on the correlation between the explanatory variables and the time constant unobserved errors. The most generally accepted way of choosing between fixed and random effects is running a Hausman test. The Hausman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results. Under the null hypothesis of Hausman test, the random effects estimator is consistent and efficient, but under the alternative it is inconsistent. Meanwhile, the fixed effects estimator is consistent under the null or the alternative; it is inefficient under the null. In the results of Hausman test, if the p value is significant, then it is safe to use fixed effects. If it is insignificant, the random effects should be used. Hausman test results can be found under the Empirical Analysis section.

*3.3.2 Empirical Results*

In panel data estimation, we test two models on three different dataset. First, we use Easterlin data for years between 1880 and 1950. Second we test models with the Census data set from 1930 to 2004, and lastly, we combine two data sets, and run the models. We run the models using both Fixed Effects Estimators and Random Effect Estimators.

In the model with percentage of foreign born, we have the consistent results with the previous section. The results in Table 8 show that we have statistically significant negative coefficient for initial per capita income. This is what we expect to find, and also it is consistent with the theory. On the other hand, the percentage of the foreign born turns out to be negative, and it is statistically significant. These results imply that after controlling the initial level of income, the per capita GDP growth of state decreases, as the percentage of foreign born increases.

When we look into Hausman test results in order to decide between fixed effects model and random effects model, the results indicate us that fixed effects model perform better than the random effects model when we use Easterlin Data and Census Data.

Table 8 – Panel Data Estimation with Percentage of Foreign Born Population

| ***DATA SET*** | ***EASTERLIN*** | | ***1930-2004*** | | ***ALL DATA*** | |
|---|---|---|---|---|---|---|
| | ***FE*** | ***RE*** | ***FE*** | ***RE*** | ***FE*** | ***RE*** |
| Initial GDP | 0000282 (.0000345) | -.000052** (.0000221) | -.0000286*** (2.06e-06) | -.0000258*** (1.80e-06) | -.000032*** (2.00e-06) | -.0000304*** (1.71e-06) |
| % of Foreign Born | -.0118691** (.0054879) | -.008632*** (.0024635) | -.0139095*** (.003) | -.0058791*** (.001661 ) | -.0085291*** (.0016518) | -.006658*** (.001087) |
| Constant | .5423471*** (.12501) | .6997107*** (.0480388) | .5905879*** (.03) | .520256*** (.0204131) | .6065175*** (.025184 ) | .5799663*** (.0184748) |
| $R^2$ | 0.1699 | 0.2486 | 0.3456 | 0.3660 | 0.3791 | 0.3812 |
| | | | | | | |
| | ***$chi^2(2)$*** | ***Prob>$chi^2$*** | ***$chi^2(2)$*** | ***Prob>$chi^2$*** | ***$chi^2(2)$*** | ***Prob>$chi^2$*** |
| Hausman Test | 14.55 | 0.0007 | 10.81 | 0.0045 | 2.46 | 0.2919 |
| | | | | | | |
| | | | | | | |

(*) Significant at 1% level
(**) Significant at 5% level
(***) Significant at 10% level
Easterlin: refers to data collected by Easterlin (1968) cover the time period of 1880-1920
1930-2004: refers to data comes from the U.S Census cover the time period of 1930-2004
All Data: Combination of the Easterlin and U.S. Census data
FE: Fixed Effects Model
RE: Random Effects Model

In the model with diversity index, we still have the negative sign for the initial level of income. This is consistent with both the previous results and literature. However, the results in Table 9 reveal that after controlling for the initial income, the diversity is significantly positively related with the per capita GDP Growth. It means that the per capita GDP Growth will increase, as the diversity increases. In other words, as more people comes from different countries, the per capita income growth increases. The Hausman test results of this model indicate us to use Fixed Effects Models in all of the three datasets.

**Table 9 – Panel Data Estimation with Diversity Index**

| | ***EASTERLIN*** | | ***1930-2004*** | | ***ALL DATA*** | |
|---|---|---|---|---|---|---|
| | ***FE*** | ***RE*** | ***FE*** | ***RE*** | ***FE*** | ***RE*** |
| Initial GDP | -.00014*** (2.19E-05) | 6.53E-06 (0.00) | -.0000338*** (3.65e-06) | -.0000337*** (3.18e-06 ) | -.0000352*** (3.18e-06) | -.000037*** (2.97e-06) |
| Diversity | .57559*** (.248) | 0.721661 (.588) | 8915246 (.1179874) | .7106799*** (.096) | .8492972*** (.1117) | .6827919*** (.0938979) |
| Constant | | 0.407** (.205) | -.185773 (.0899562 ) | -.036 (.075) | -.136362 (.088633) | .0129062 (.0753079) |
| $R^2$ | 0.0004 | 0.3164 | 0.3348 | 0.3439 | 0.3243 | 0.3336 |
| | | | | | | |
| | ***$chi^2(2)$*** | ***$Prob>chi^2$*** | ***$chi^2(2)$*** | ***$Prob>chi^2$*** | ***$chi^2(2)$*** | ***$Prob>chi^2$*** |
| Hausman | 9.12 | 0.0105 | 6.97 | 0.0083 | 7.58 | 0.0059 |
| | | | | | | |
| | | | | | | |

(*) Significant at 1% level
(**) Significant at 5% level
(***) Significant at 10% level
Easterlin: refers to data collected by Easterlin (1968) cover the time period of 1880-1920
1930-2004: refers to data comes from the U.S Census cover the time period of 1930-2004
All Data: Combination of the Easterlin and U.S. Census data

FE: Fixed Effects Model
RE: Random Effects Model

In terms of the relationship between the per capita income growth and initial level of income, our results are consistent with the related literature. On the other hand, the latest analysis shows the positive relationship between the per capita GDP Growth and diversity. These results are new to the literature and they are different from what the literature have already stated. However, further analysis is required in order to strengthen these findings. The initial level of income is included as an explanatory variable in the model, where the per capita GDP Growth is the dependent variable. This violates the assumption of uncorrelated error term and explanatory variables. In order to solve this problem, the dynamic panel data models should be used, so that we can take care of the correlation between the error term and explanatory variables and get more valid results.

# CHAPTER 4- CONCLUSION

In this thesis, we investigated empirically the impacts of immigration on the long run growth of country using data from 48 States of U.S. starting from 1880 to 2004 with the 10 year time interval. We use two different variables for diversity. The first one is % of foreign born population in state *i* in year *t*, and the second one is the diversity index, which we explained in the data chapter.

Initially, we followed the Barro(1991) exercise and plot the the growth rate of real per capita GDP and initial diversity level, using the percentage of foreign born population as a diversity variable. The results revealed that there was a negative relationship between the initial level of diversity and growth rate of real per capita GDP. Then, we tried to address the same relationship between the growth and immigration after controlling for the initial level on income. Barro and Sala-i Martin show that regions with a low level of income have faster subsequent growth. When we put the initial income into the right hand side of the equation, we got a negative coefficient for it. This is what we expected to see. Then, we analyze the relationship between the residuals and immigration variable; we found that the correlation is still negative. We repeated the same analysis by using the 20 years time horizon instead of 10 years. Nevertheless, the results did not change, and they showed the negative relationship. On the other hand, when we use the diversity index as a diversity variable, we got mixed results. Without controlling the initial level of income, we found the negative correlation between the immigration and economic growth for some decades, and had positive correlation between the immigration and economic growth for others. When we excluded the impacts of initial

income, the results did not change dramatically, only the number of decades which shows positive relationship between the immigration and growth increased, but we still had the negative correlation figures for some other decades. In addition, the change in the time horizon from 10 years to 20 years did not change the results.

In second part of the analysis, we used panel data estimation technique. We did the estimation by using three different dataset, which are Easterlin data, Census data, and combination of Easterlin and Census data and, repeated the estimations for two different diversity variables. Besides, we used both fixed effects and random effects panel data estimation techniques, and then we looked for the Hausman test results in order to decide between the fixed effects and random effects models.

At first, we used percentage of foreign born population. We had the negative coefficient for initial income level. The coefficient of diversity variable, which is percentage of foreign population, was also negative. The results were consistent with the literature. In other words, holding the initial income level constant, as the percentage of foreign born increases the per capita GDP growth of state decreases.

Then, we used the diversity index as a immigration variable, and we had the negative coefficient for the initial income level. Nonetheless, the coefficient for the diversity index was positive. It implies that the per capita GDP growth of state increases as the diversity increases.

As the next step of the research, in order to strengthen the findings and robustness of the results, the other factors, which might have influence on the economic growth, should be included into model. Education level, saving rates, and fertility are some of those factors. In this thesis, we wanted to include those variables, but we could not find enough data to include them into the model. This is the first issue that should be taken into consideration while doing a further analysis.

In addition, in the further analysis, especially while using the panel data models, the dynamic panel data models should be used because the model includes the lag value of the dependent variable, and the model violates the assumption of uncorrelated error term and explanatory variables.

# APPENDIX

# CORRELATION PLOTS

**Figure 1: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1880-1900 (Easterlin Data)**

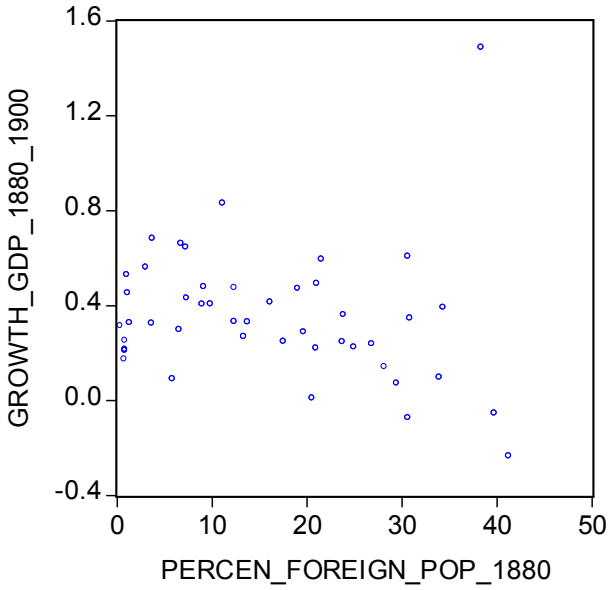



**Figure 2: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1900-1920 (Easterlin Data)**

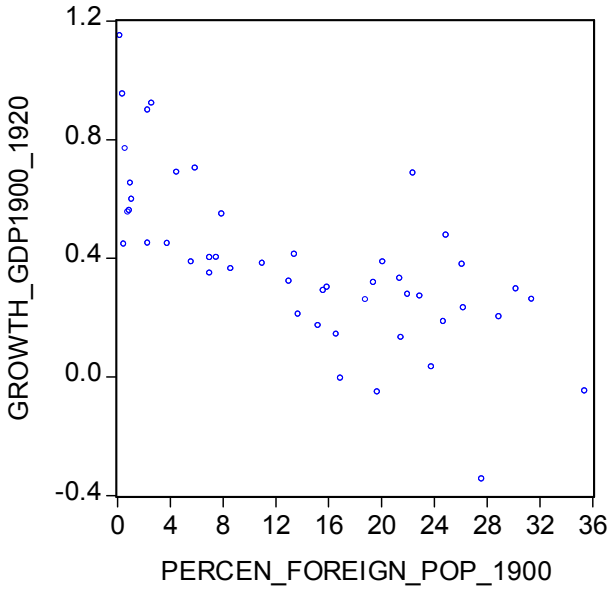


**Figure 3: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1920-1950 (Easterlin Data)**

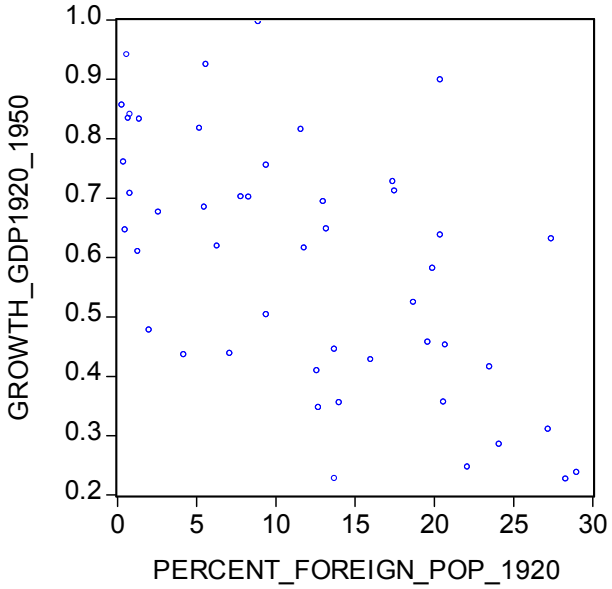



**Figure 4: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1930-1940**

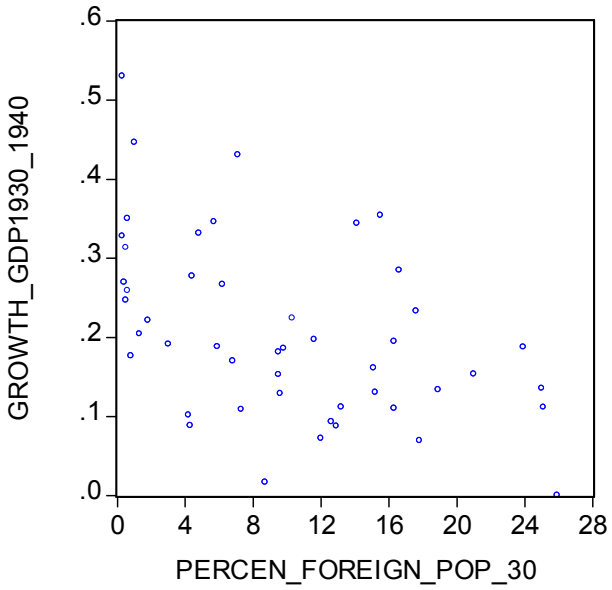


**Figure 5: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1940-1950**

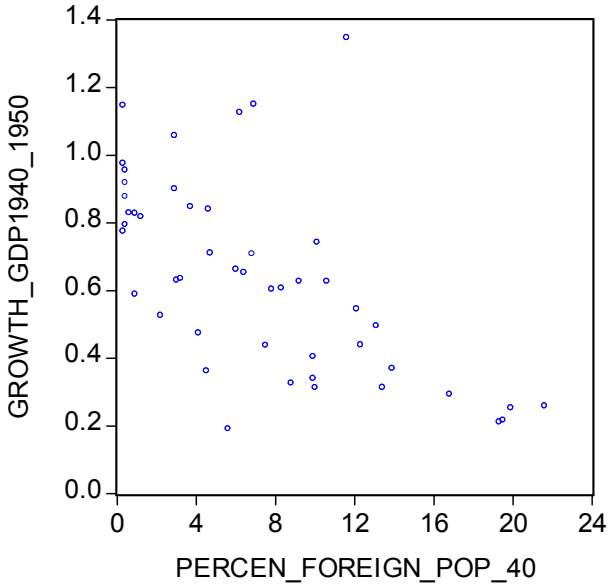



**Figure 6: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1950-1960**

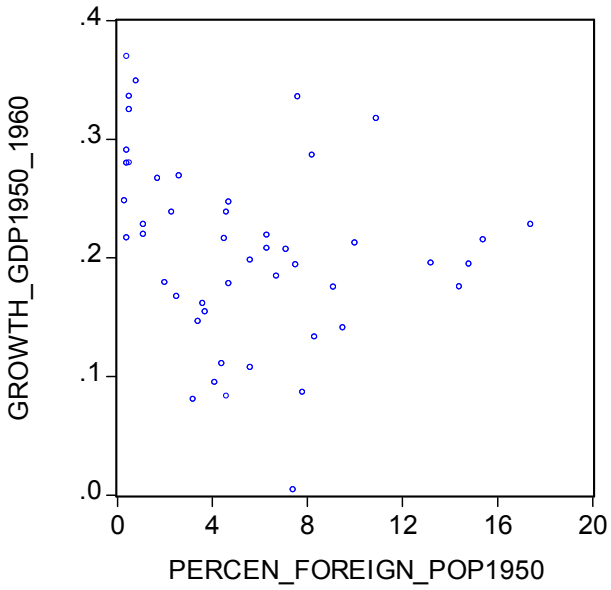


**Figure 7: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1960-1970**

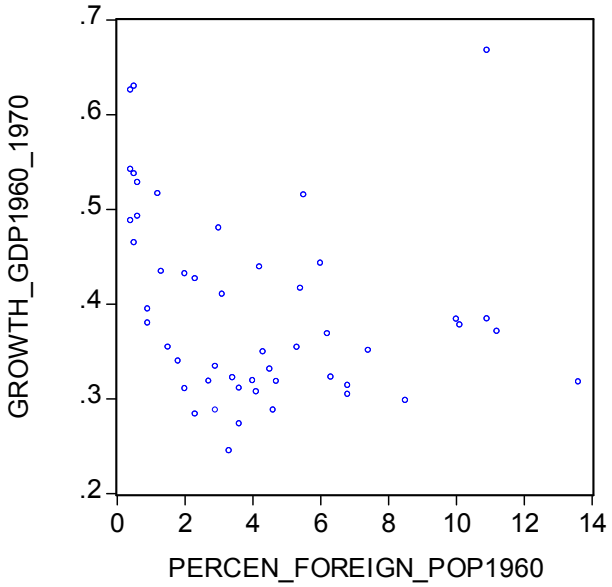



**Figure 8: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1970-1980**

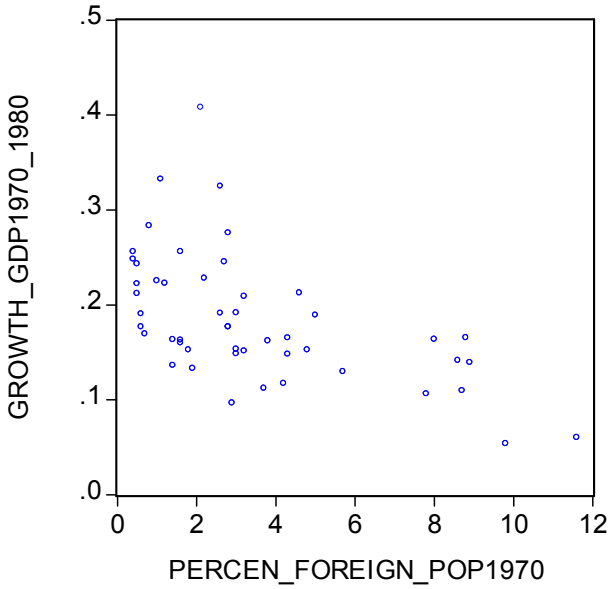


**Figure 9: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1980-1990**

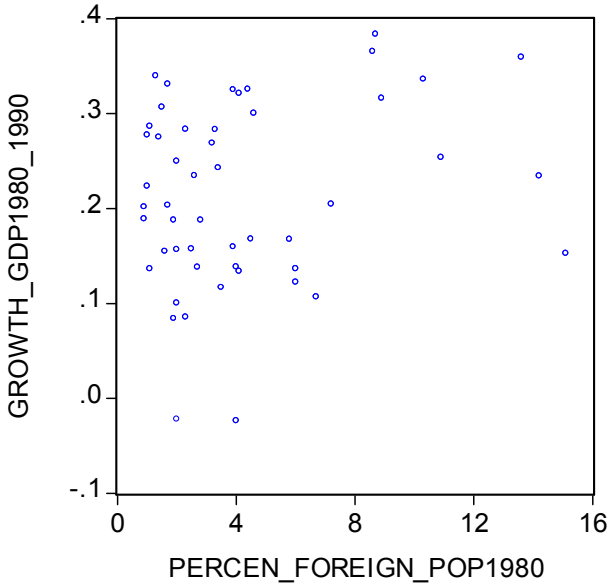



**Figure 10: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1990-2000**

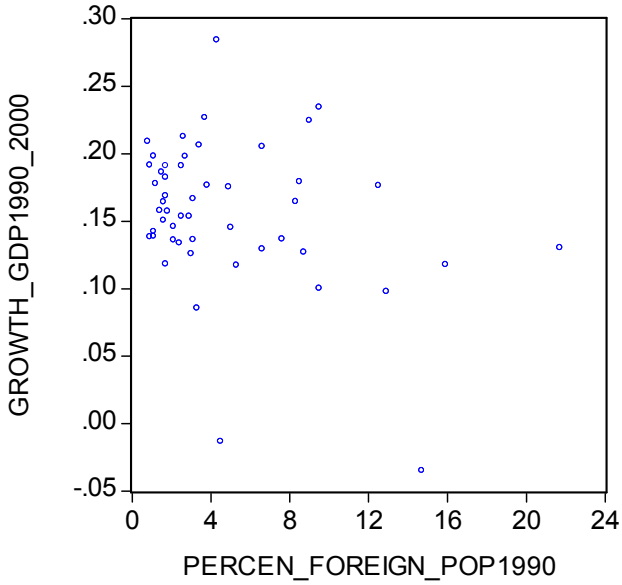


**Figure 11: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 2000-2004**

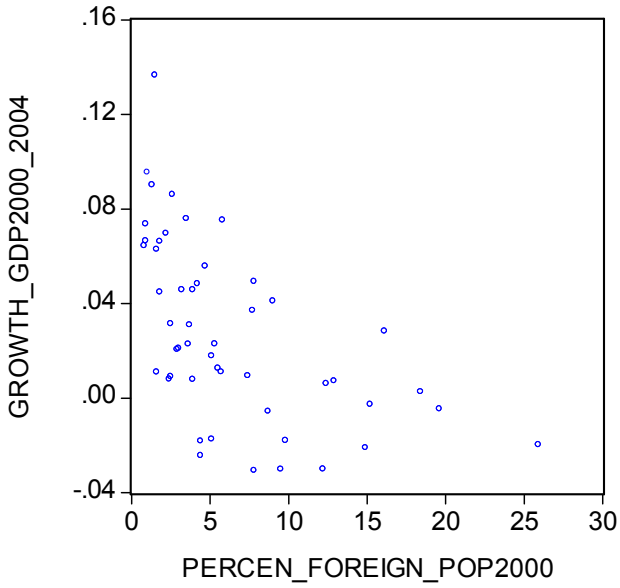


**Figure 12: Correlation between the Residuals and Percentage of Foreign Born Population 1880-1900**

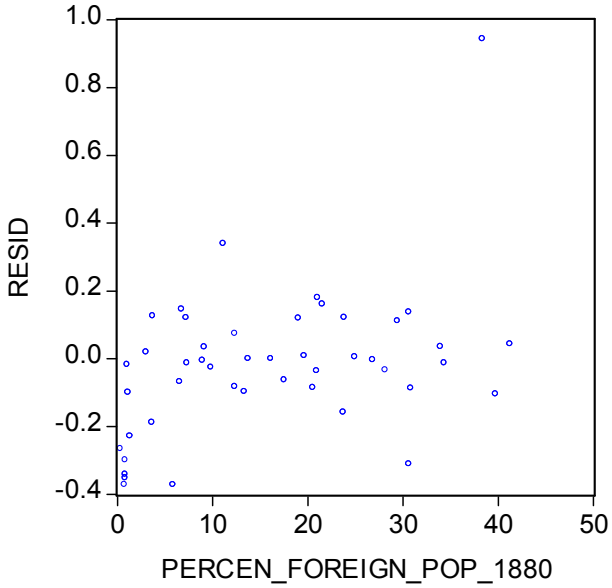



**Figure 13: Correlation between the Residuals and Percentage of Foreign Born Population 1900-1920**

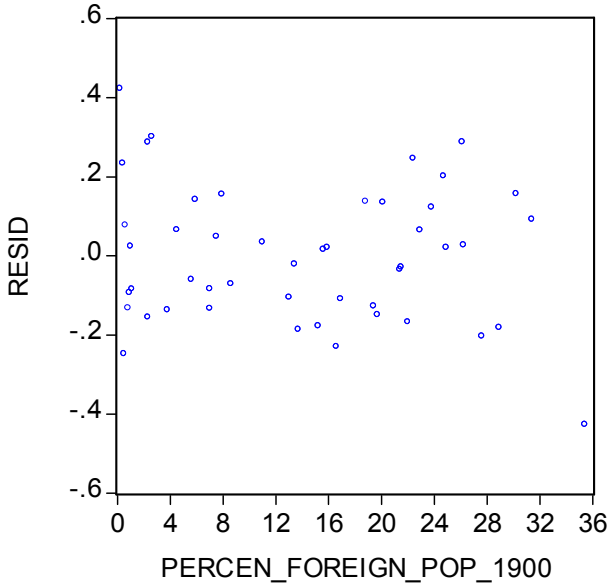


**Figure 14: Correlation between the Residuals and Percentage of Foreign Born Population 1920-1950**

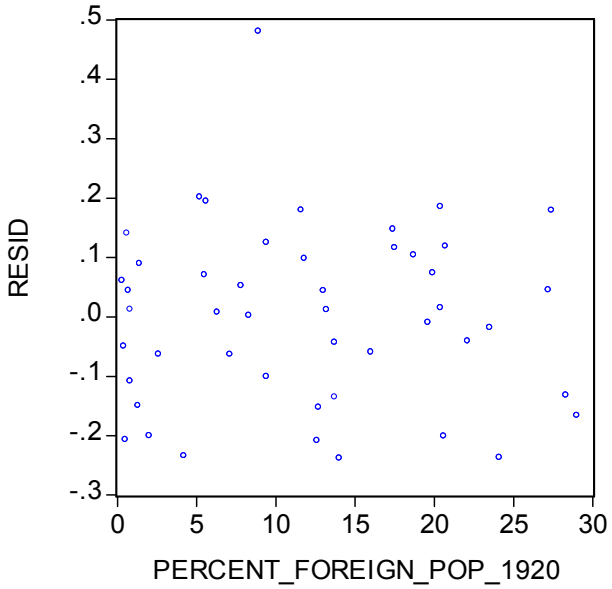



**Figure 15: Correlation between the Residuals and Percentage of Foreign Born Population 1930-1940**

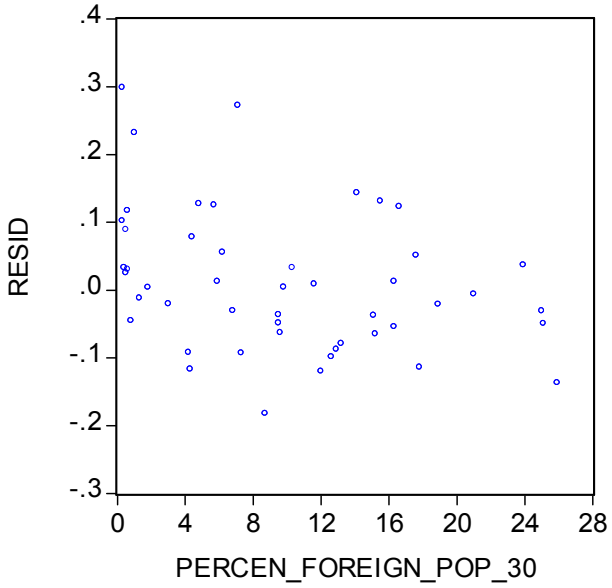


**Figure 16: Correlation between the Residuals and Percentage of Foreign Born Population 1940-1950**

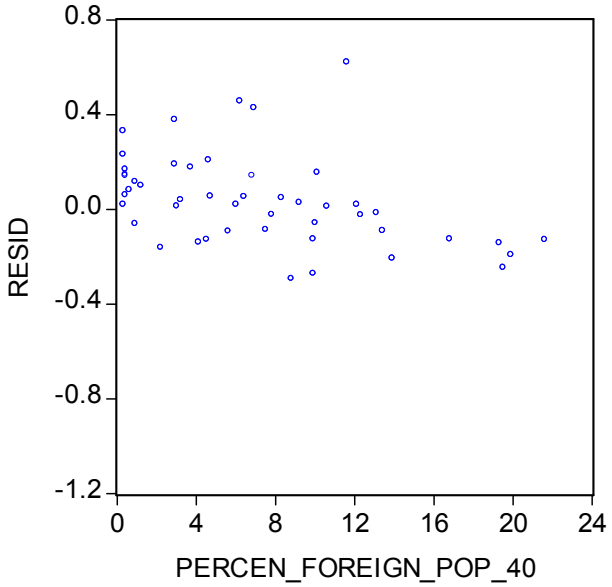



**Figure 17: Correlation between the Residuals and Percentage of Foreign Born Population 1950-1960**

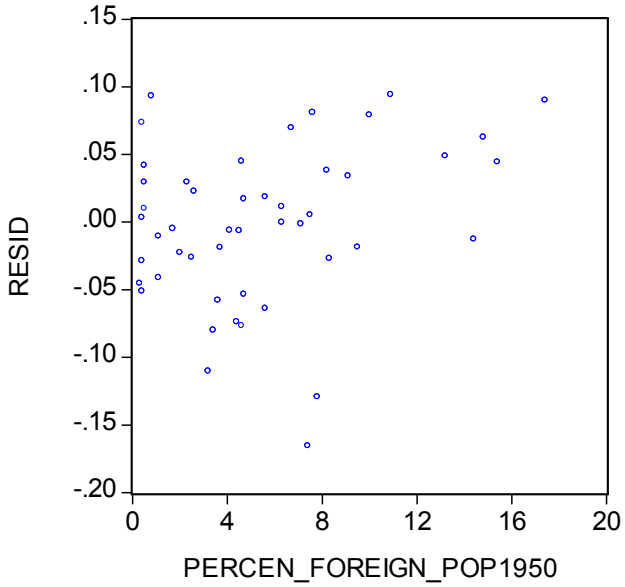


**Figure 18: Correlation between the Residuals and Percentage of Foreign Born Population 1960-1970**

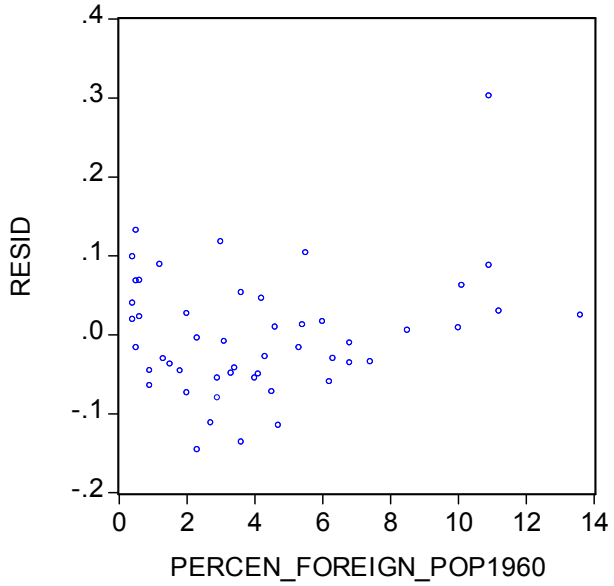



**Figure 19: Correlation between the Residuals and Percentage of Foreign Born Population 1970-1980**

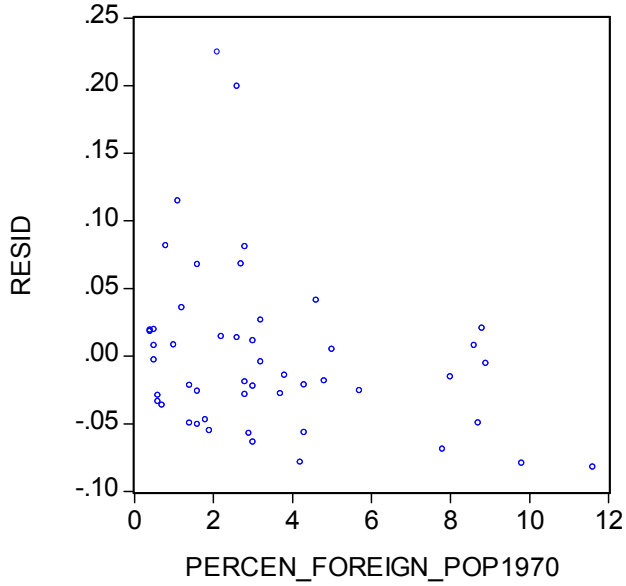


**Figure 20: Correlation between the Residuals and Percentage of Foreign Born Population 1980-1990**

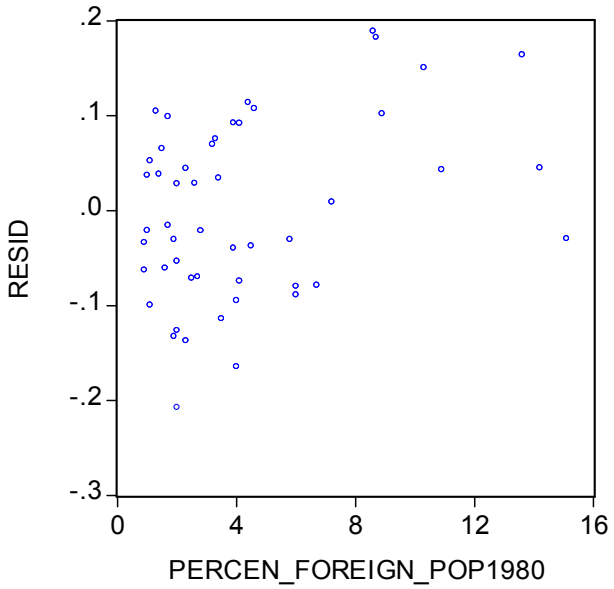



**Figure 21: Correlation between the Residuals and Percentage of Foreign Born Population 1990-2000**

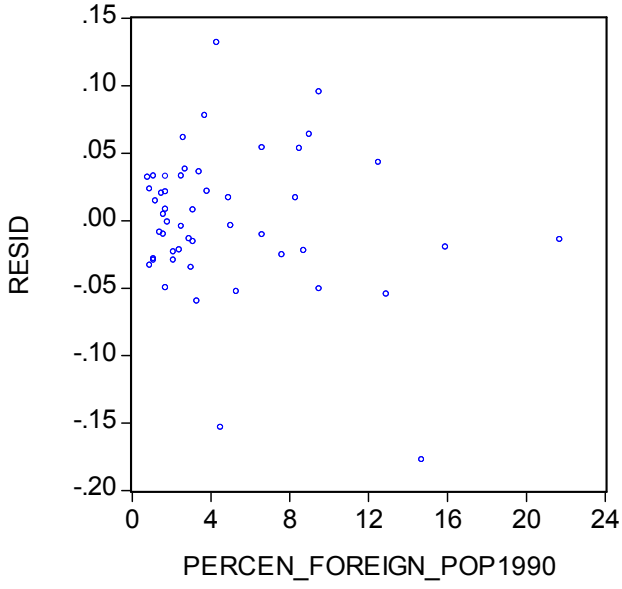


**Figure 22: Correlation between the Residuals and Percentage of Foreign Born Population 2000-2004**

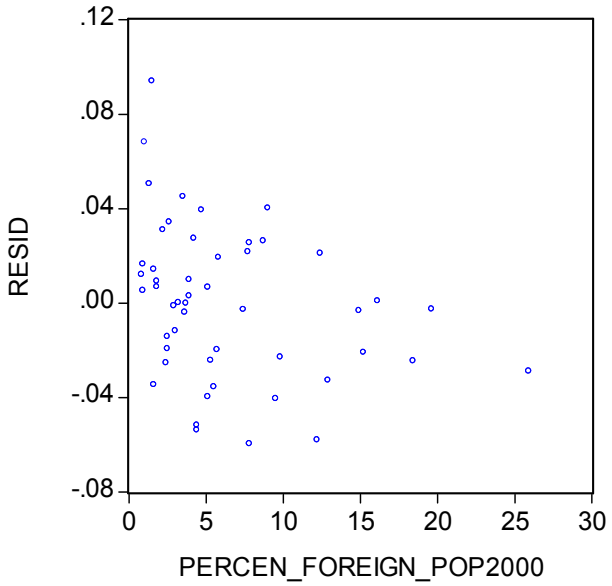


**Figure 23: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1930-1950**

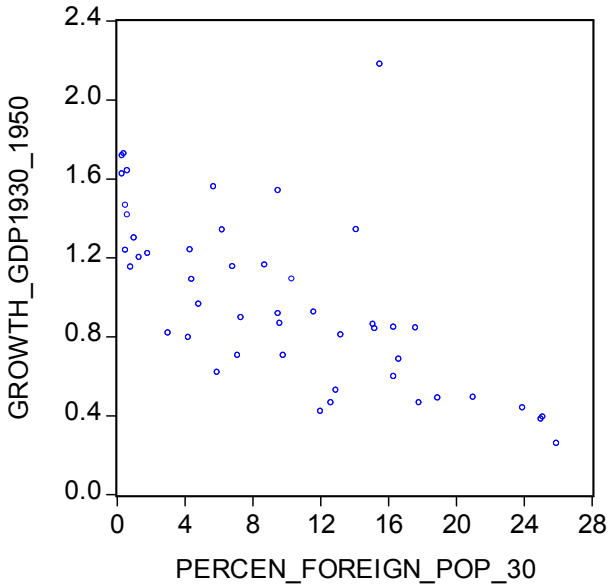



**Figure 24: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1940-1960**

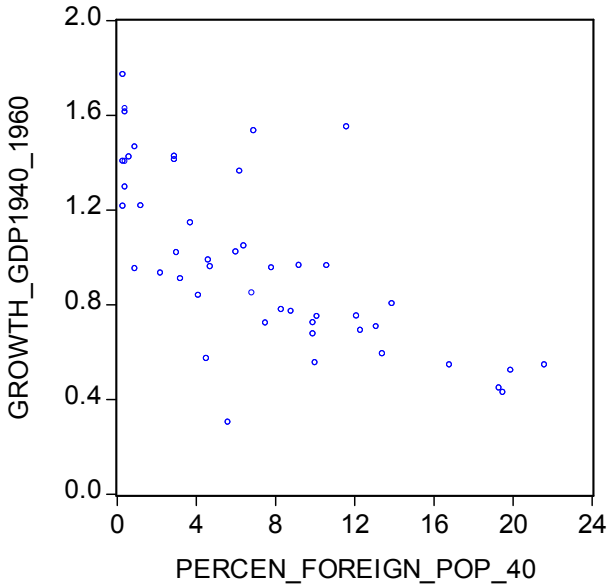


**Figure 25: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1950-1970**

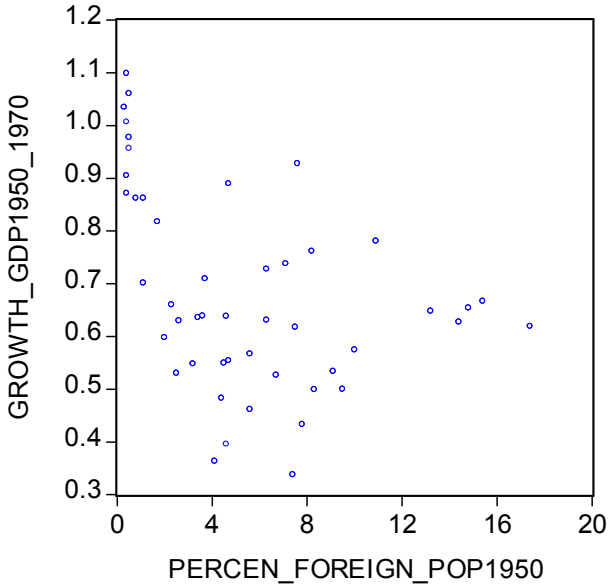



**Figure 26: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1960-1980**

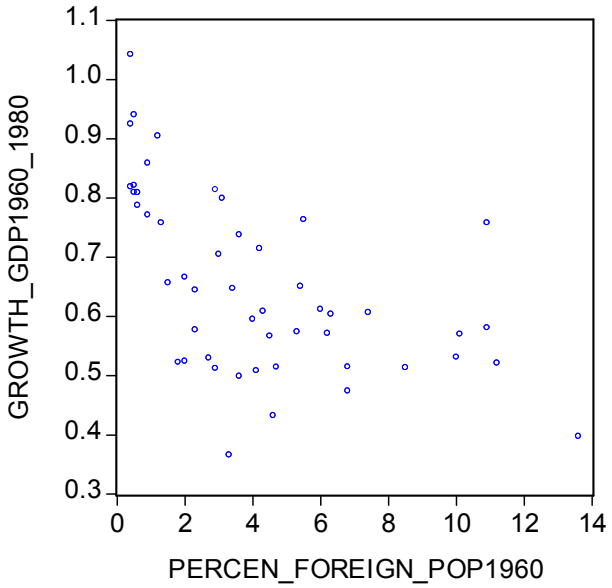


**Figure 27: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1970-1990**

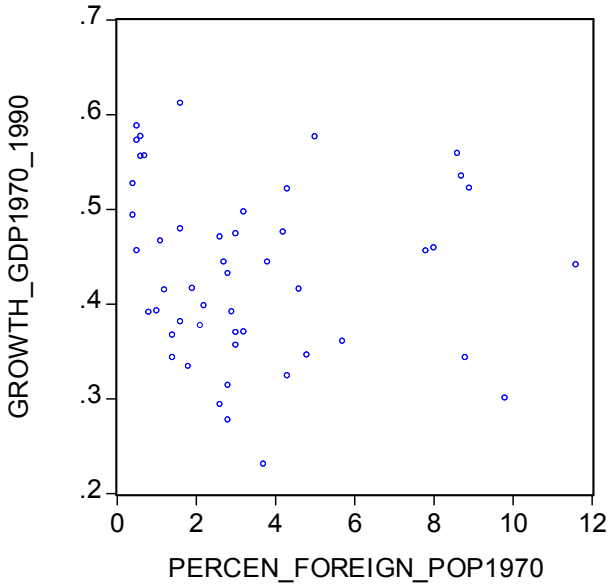



**Figure 28: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1980-2000**

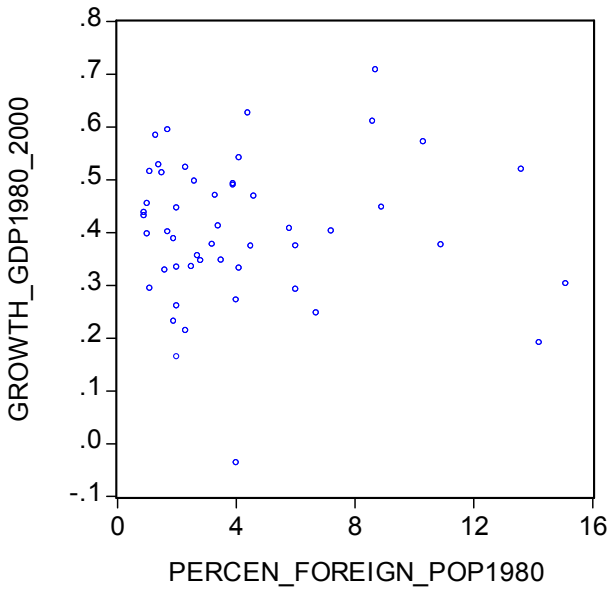


**Figure 29: Correlation between the per capita GDP Growth and Percentage of Foreign Born Population 1990-2004**

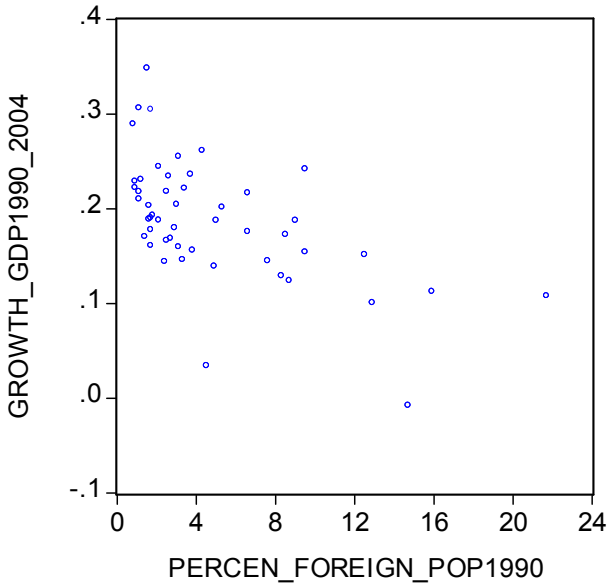


**Figure 30: Correlation between the Residuals and Percentage of Foreign Born Population 1930-1950**

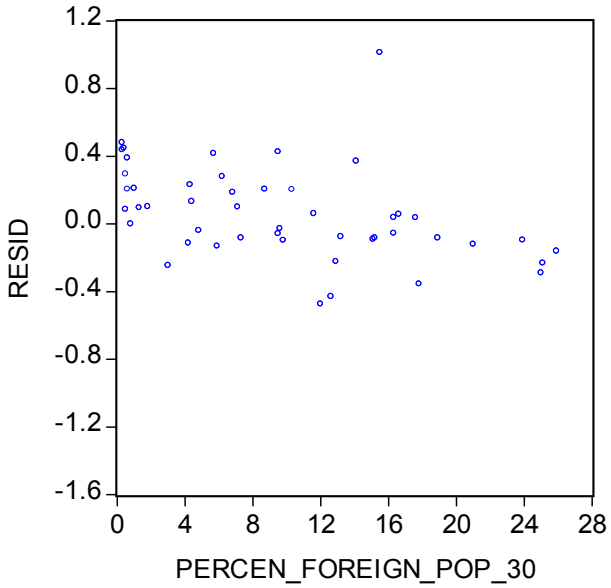



**Figure 31: Correlation between the Residuals and Percentage of Foreign Born Population 1940-1960**

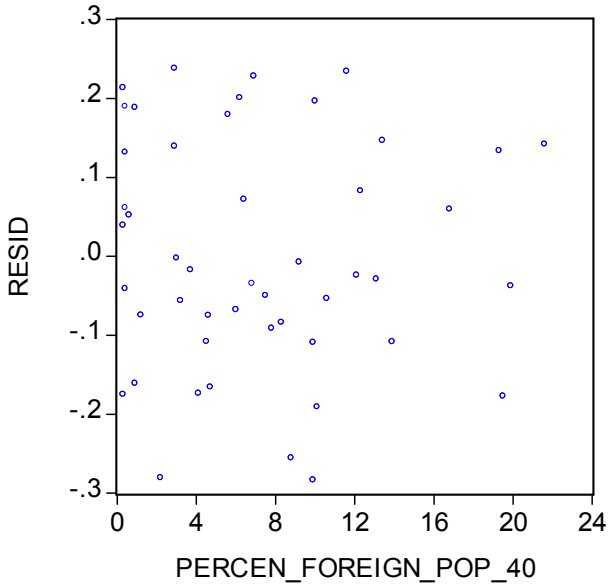


**Figure 32: Correlation between the Residuals and Percentage of Foreign Born Population 1950-1970**

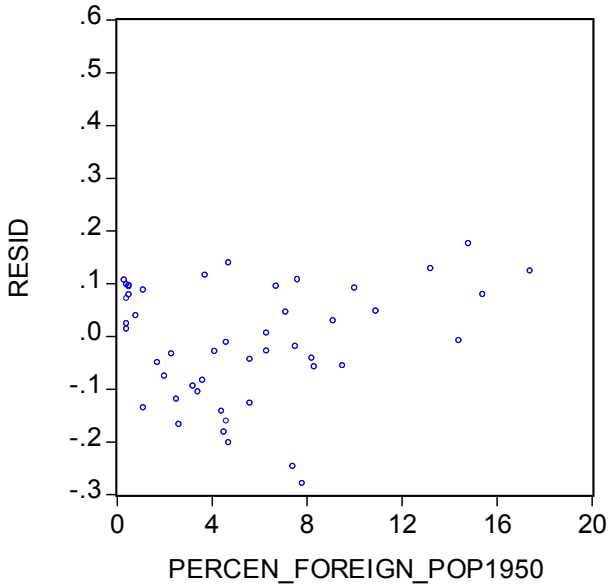



**Figure 33: Correlation between the Residuals and Percentage of Foreign Born Population 1960-1980**

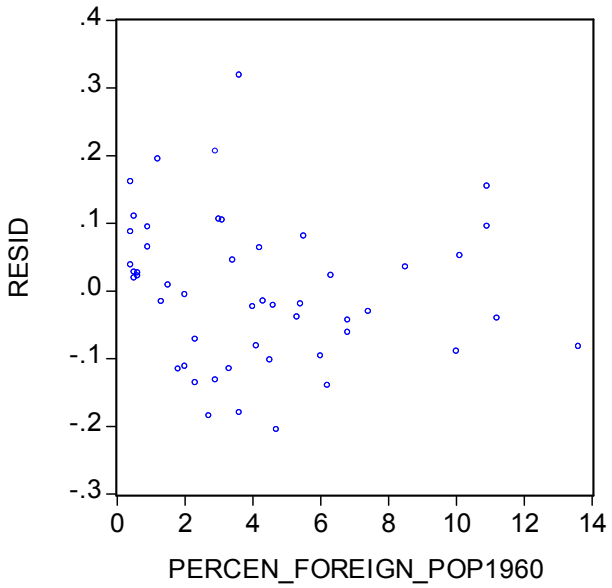


**Figure 34: Correlation between the Residuals and Percentage of Foreign Born Population 1970-1990**

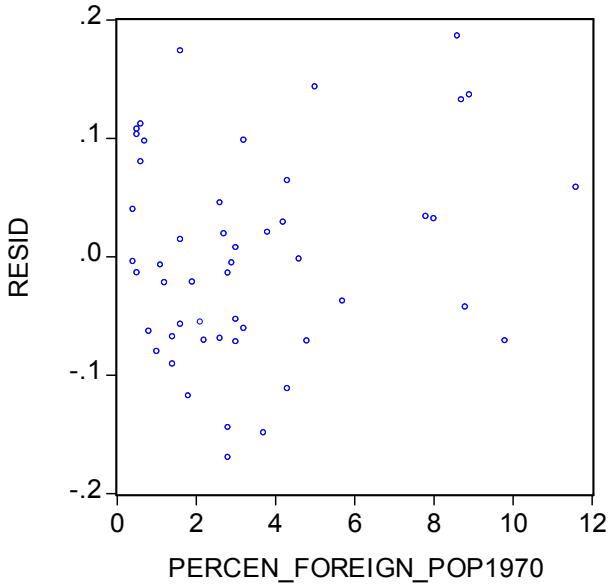



**Figure 35: Correlation between the Residuals and Percentage of Foreign Born Population 1980-2000**

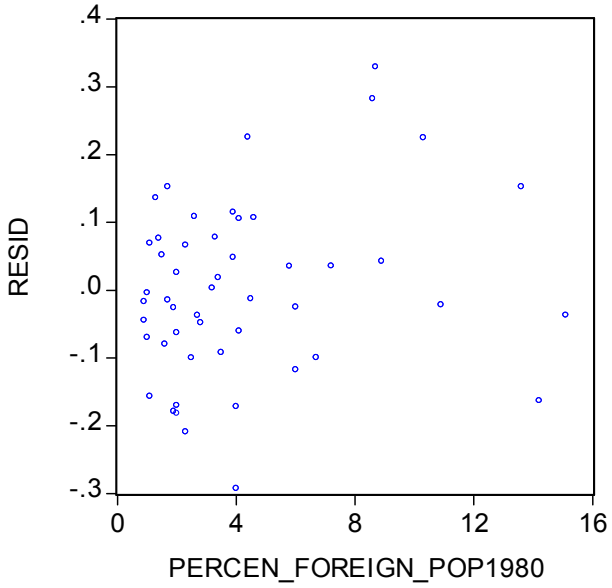


**Figure 36: Correlation between the Residuals and Percentage of Foreign Born Population 1990-2004**

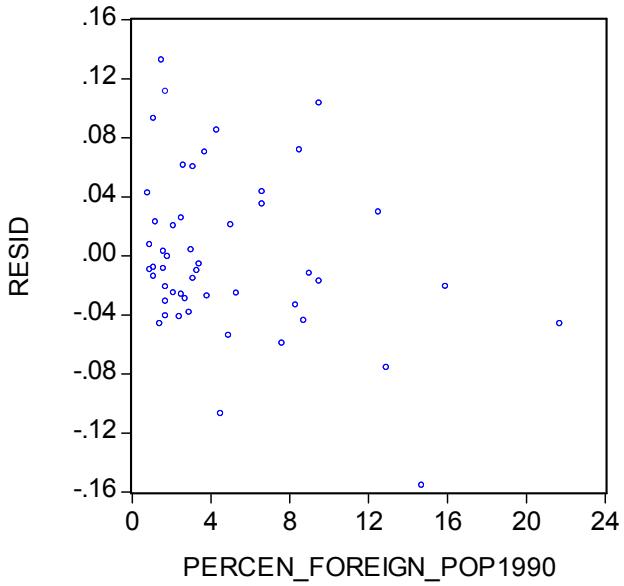


**Figure 37: Correlation between the per capita GDP Growth and Diversity Index 1900-1920 (Easterlin Data)**

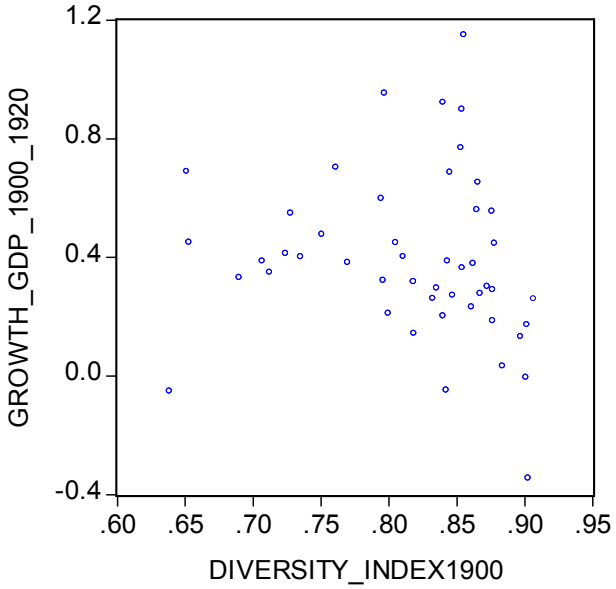



**Figure 38: Correlation between the per capita GDP Growth and Diversity Index 1920-1950 (Easterlin Data)**

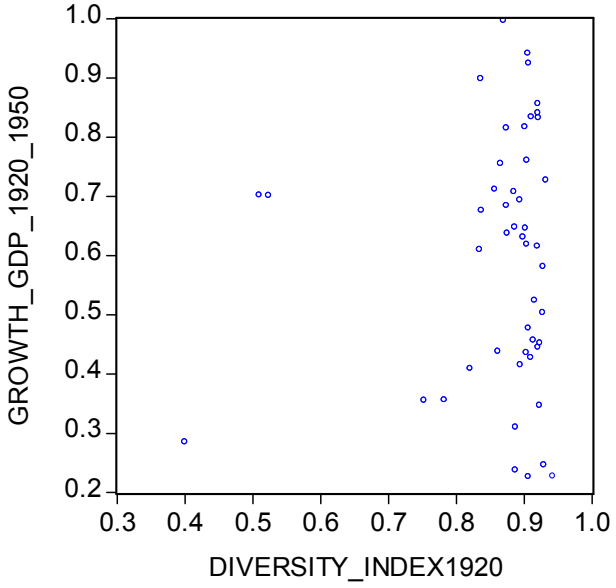


**Figure 39: Correlation between the per capita GDP Growth and Diversity Index 1930-1940**

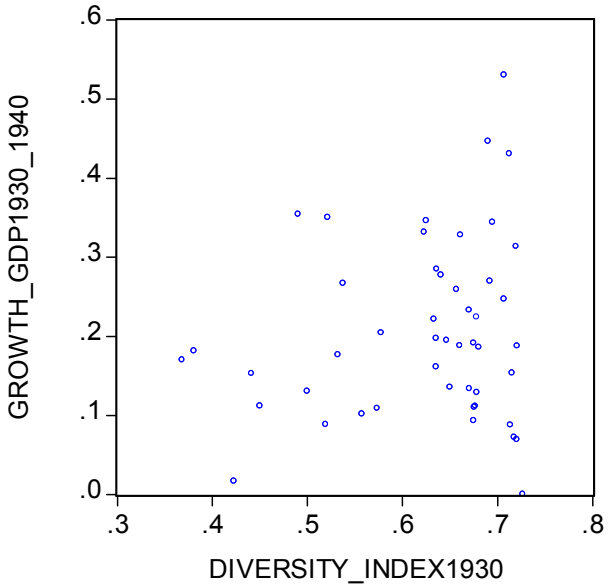



**Figure 40: Correlation between the per capita GDP Growth and Diversity Index 1940-1950**

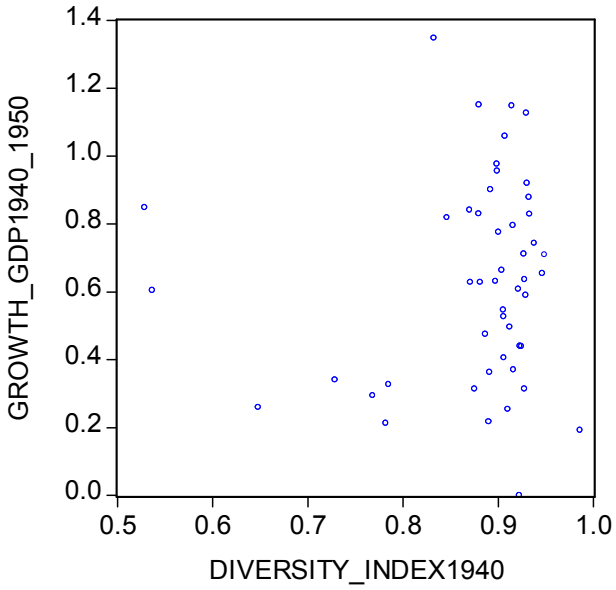


**Figure 41: Correlation between the per capita GDP Growth and Diversity Index 1950-1960**

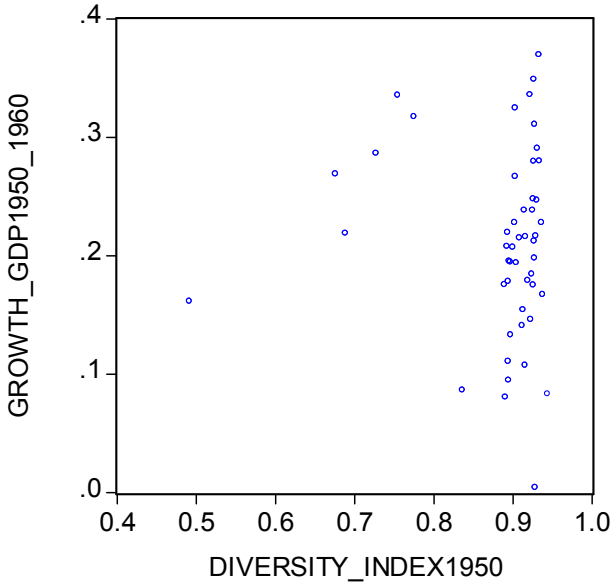



**Figure 42: Correlation between the per capita GDP Growth and Diversity Index 1960-1970**

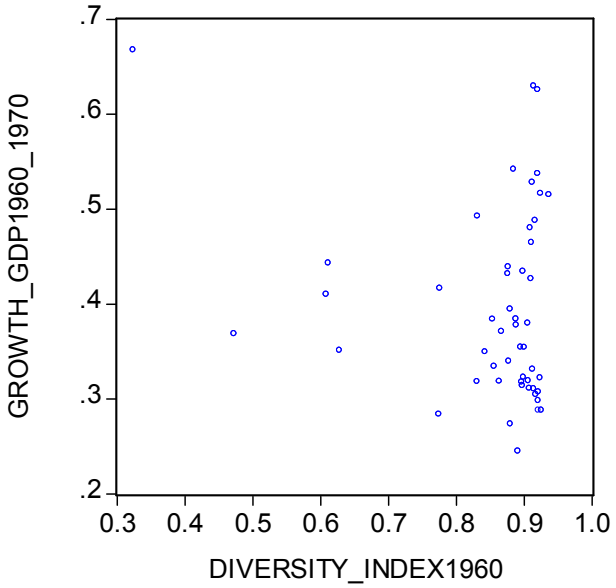


**Figure 43: Correlation between the per capita GDP Growth and Diversity Index 1990-2000**

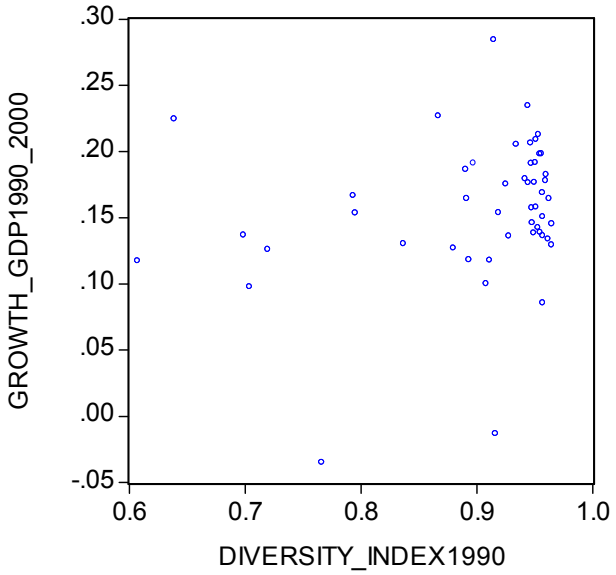


**Figure 44: Correlation between the Residuals and Diversity Index 1900-1920**

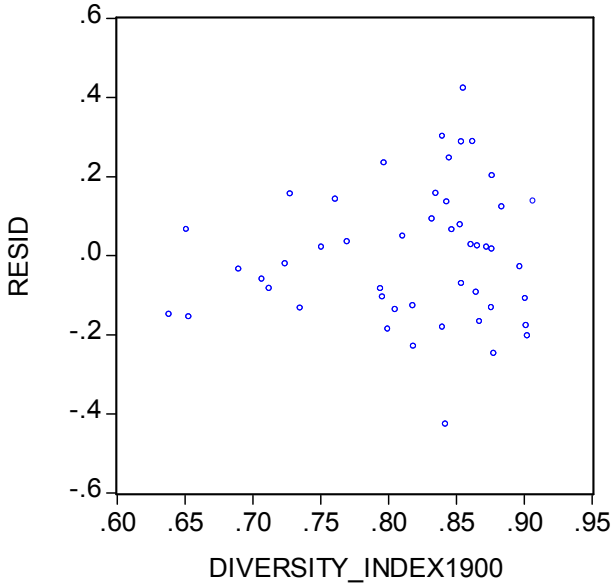



**Figure 45: Correlation between the Residuals and Diversity Index 1920-1950**

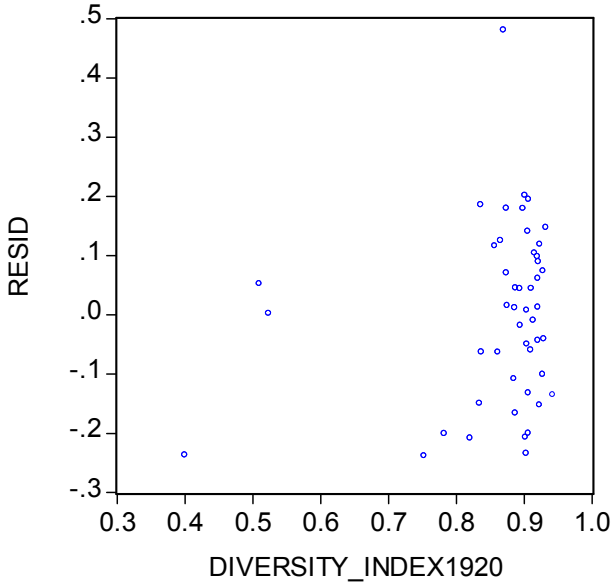


**Figure 46: Correlation between the Residuals and Diversity Index 1930-1940**

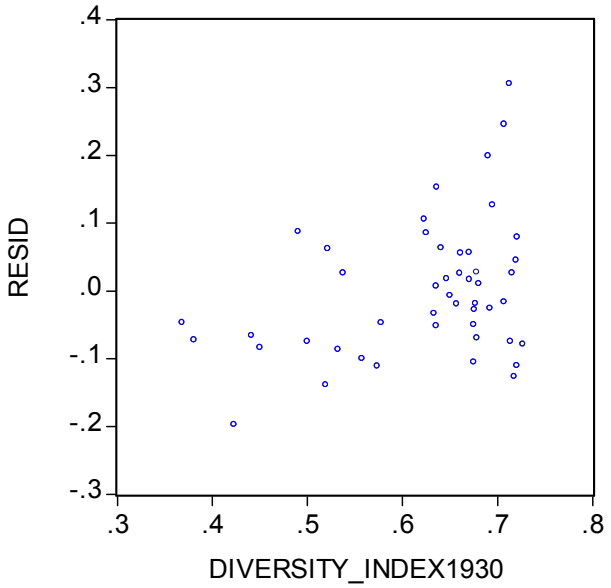



**Figure 47: Correlation between the Residuals and Diversity Index 1940-1950**

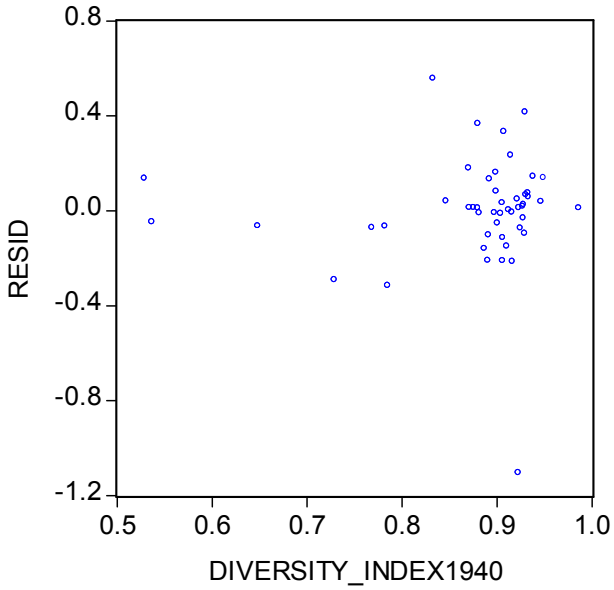


**Figure 48: Correlation between the Residuals and Diversity Index 1950-1960**

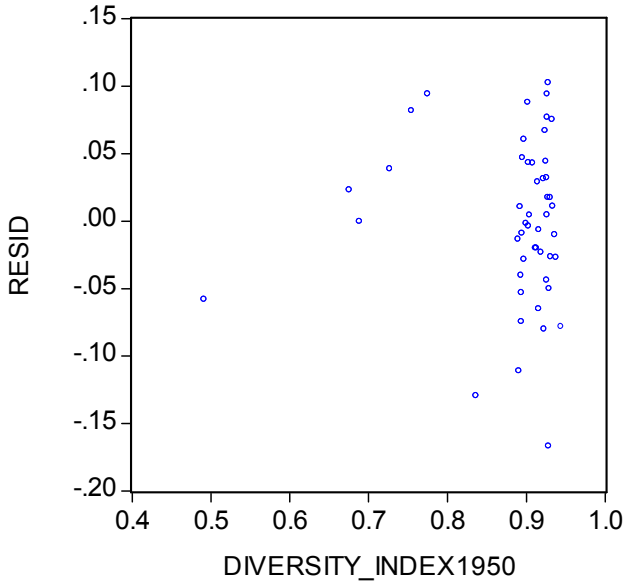



**Figure 49:Correlation between the Residuals and Diversity Index 1960-1970**

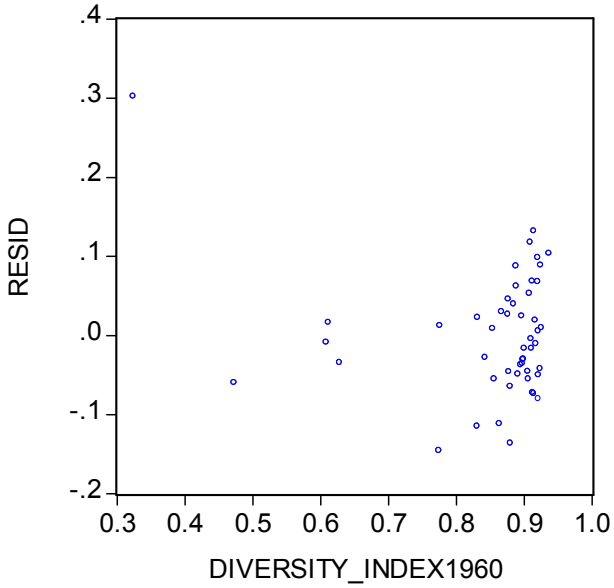


**Figure 50: Correlation between the Residuals and Diversity Index 1990-2000**

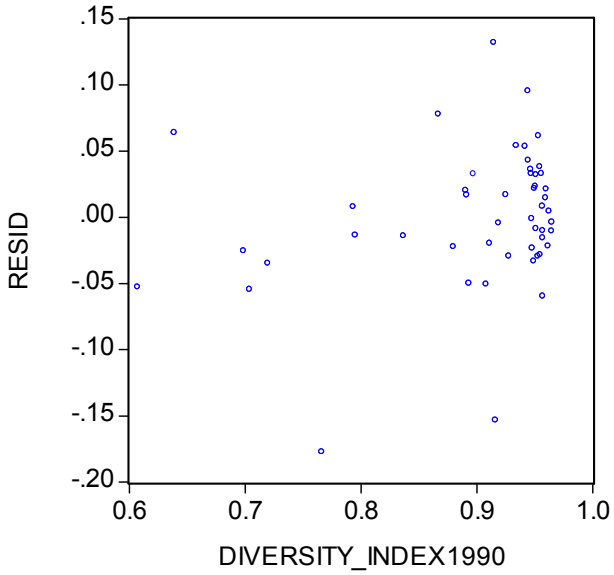


**Figure 51: Correlation between the per capita GDP Growth and Diversity Index 1930-1950**

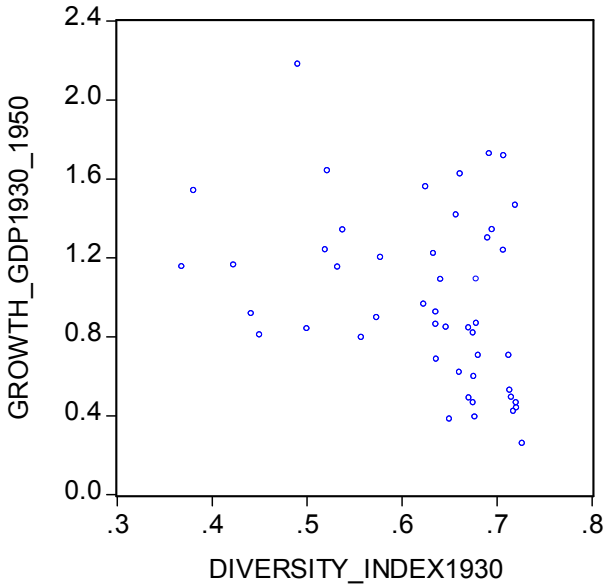



**Figure 52: Correlation between the per capita GDP Growth and Diversity Index 1940-1960**

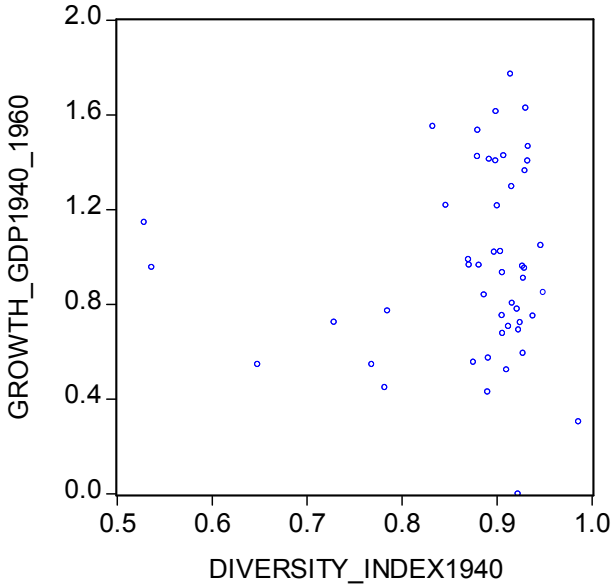


**Figure 53: Correlation between the per capita GDP Growth and Diversity Index 1950-1970**

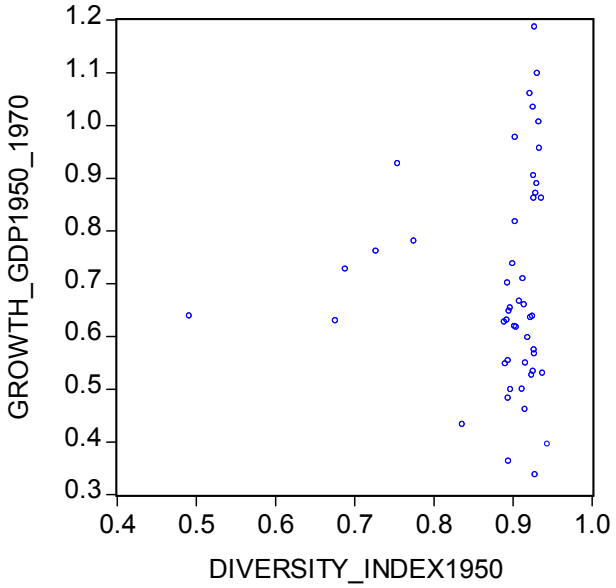



**Figure 54: Correlation between the per capita GDP Growth and Diversity Index 1960-1980**

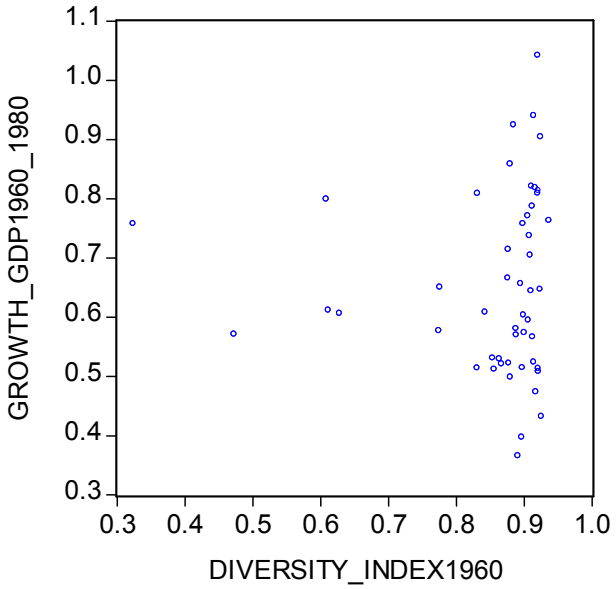


**Figure 55: Correlation between the per capita GDP Growth and Diversity Index 1990-2004**

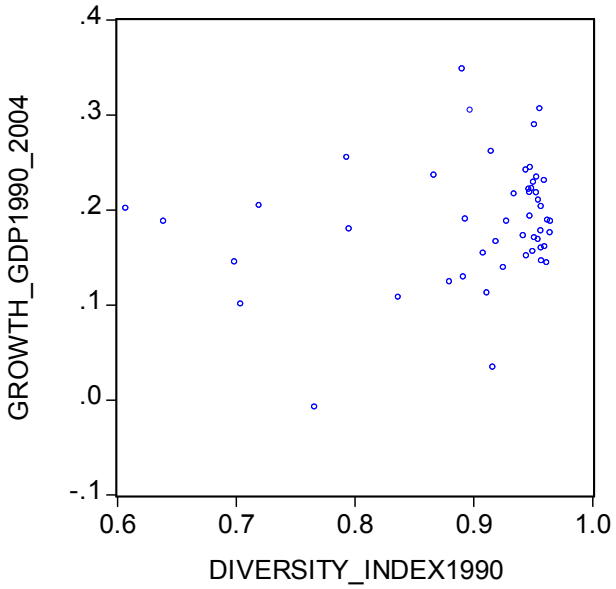



**Figure 56: Correlation between the Residuals and Diversity Index 1930-1950**

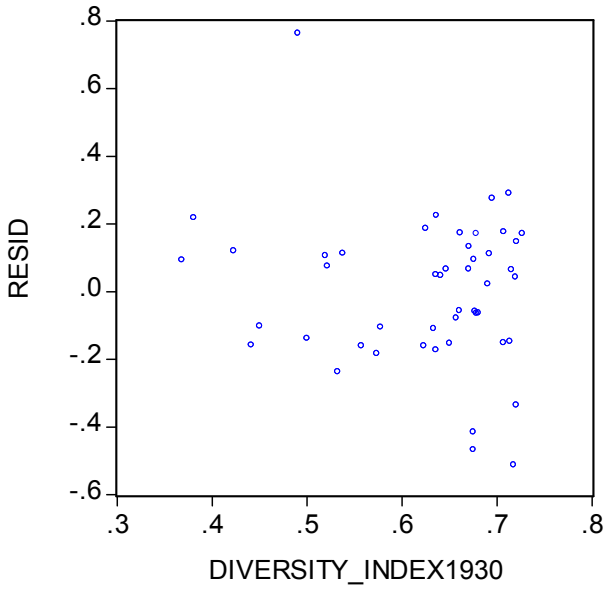


**Figure 57: Correlation between the Residuals and Diversity Index 1940-1960**

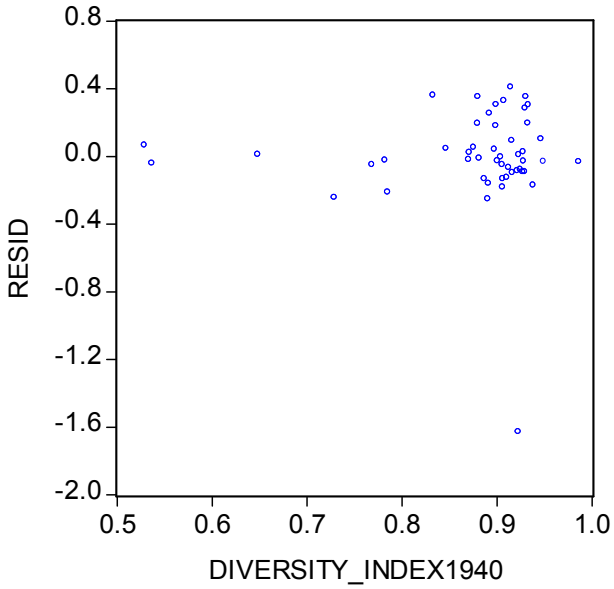



**Figure 58: Correlation between the Residuals and Diversity Index 1950-1970**

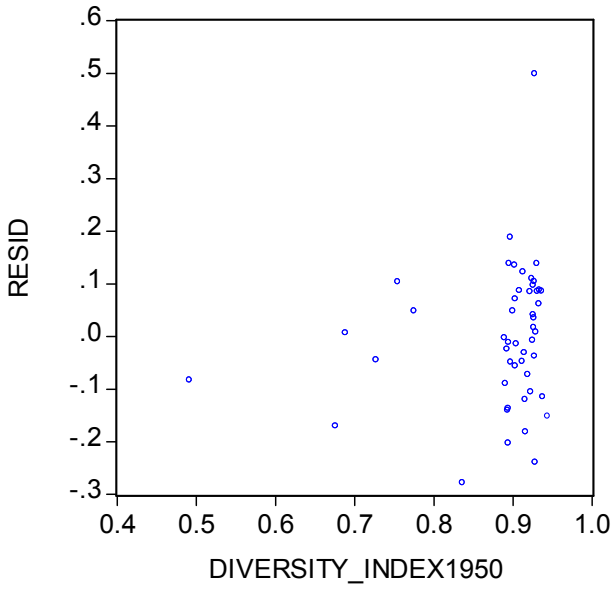


**Figure 59: Correlation between the Residuals and Diversity Index 1960-1980**

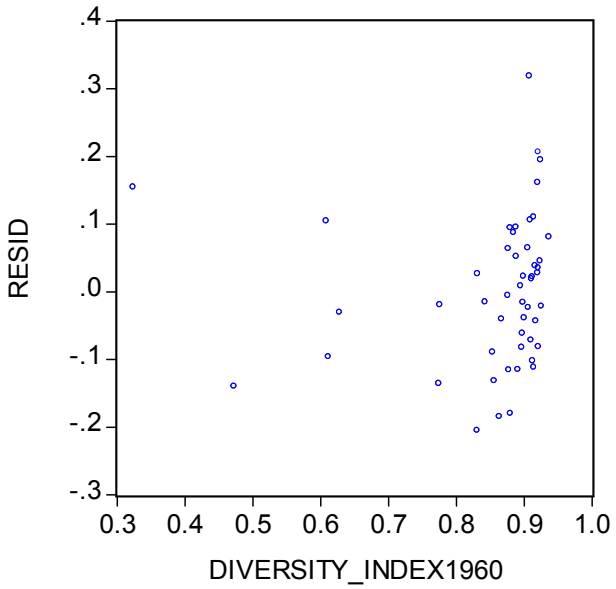
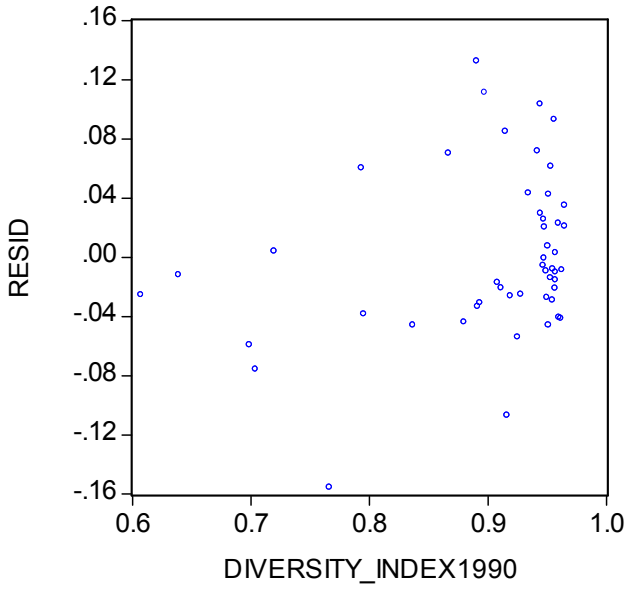



**Figure 60: Correlation between the Residuals and Diversity Index 1990-2004**



## REFERENCES


Ades A. and E Glaeser (1995), "Trade and circuses: explaining urban giants", *Quarterly Journal of Economics*, 122, 195-228.

Alesina, A., R. Baqir and W. Easterly (1999), "Public Goods and Ethnic Divisions", *Quarterly Journal of Economics*, 114 (4), 1243-1284.

Alesina, A., R. Baqir and C. Hoxby (2004), "Political Jurisdictions in Heterogeneous Communities", *Journal of Political Economy,* 112 (2): 348-96

Alesina, A., A. Devleschawuer, W. Easterly, S. Kurlat and R. Wacziarg (2003), "Fractionalization", *Journal of Economic Growth*, 8, 155-94

Alesina, A. and E. Glaeser (2004), Fighting poverty in the US and Europe: a world of difference, Oxford and New York University Press

Alesina A. E. Glaeser and B. Sacerdote (2001), "Why Doesn't the US Have a European Style Welfare State?" *Brookings Papers on Economic Activity*, 2: 187-254

Alesina, A. and E. La Ferrara (2000), "Participation in Heterogeneous Communities", *Quarterly Journal of Economics*, 115 (3), 847-904.

Alesina A. and E. La Ferrara (2002), "Who Trust Others?" *Journal of Public Economics*, 85 (2): 207-34

Alesina, A. and E. Spolaore (1997), "On the Number and Size of Nations," *Quarterly Journal of Economics*, 112 (4), 1027-56.

Alesina, A., E. Spolaore and R. Wacziarg (2000), "Economic Integration and Political Disintegration", *American Economic Review*, 90(5): 1276-96

Alesina A. and R. Wacziarg (1998), "Openness, Country Size and Government", *Journal of Public Economics*, vol. 69, no. 3, September, p. 305-321.

Alesina, A. and La Ferrara E. 2005 " Ethnic Diversity and Economic Performance." *Journal of Economic Literature*, 48(3): 762-800

Arcand, J.-L., P. Guillaumont and S. Guillaumont Jeanneney (2000), "How to Make a Tragedy: On the Alleged E.ect of Ethnicity on Growth", *Journal of International Development*, 12, 925-938.

Barro, Robert J. (1991) "Economic Growth in a Cross-Section of Countries", *Quarterly Journal of Economics* 106(2):407-433.

Barro, Robert J., and Sala-i-Martin X.(2003) Economic Growth, 2nd Edition, MIT Press

Bannon, A. Edward M., and Posner D.. 2004. " Sources of Ethnic Identification in Africa" *University of California at Los Angeles. Mimeo*.

Berman, Eli. 2000, "Sect, Subsidy, and Sacrifice: An Economist's View of Ultra-Orthodox Jews" *Quarterly Journal of Economics*, 115(3); 905-53

Bigsten, A., P. Kimuyu, and K. Lundvall (2000), "Informality, Ethnicity, and Productivity. Evidence from Small Manufacturers in Kenya", *Dept. of Economics Working Paper 27*, Goteborg University

Blanchard O. and L. Katz (1992) "Regional Evolutions" *Brookings Papers on Economic Activity,* 1, 1-76

Bloch, F., and Vijayendra, R.. 2001. "Statistical Discrmination and Social Assimilitaion" *Economics Bulletin*, 10(2):1-5

Borjas, George J. (1983) "The substitutability of black, Hispanic, and white labor", *Economic Inquiry*, 21(1):93-106.

Borjas, George J. (1985) "Assimilation, changes in cohort quality, and the earnings of immigrants", *Journal of Labor Economics*, 3(4):463-489.

Borjas, George J. (1987) "Self-selection and the earnings of immigrants", *American Economic Review*, 77(4):531-553.

Borjas, George J. (1991) "Immigration and self-selection", in: John M. Abowd and Richard B. Freeman, eds., *Immigration, Trade, and the Labor Market*. Chicago: University of Chicago Press, 29-76.

Borjas, George J. (1992) "Ethnic capital and intergenerational mobility", *Quarterly Journal of Economics*, 107(1):123-150.

Borjas, George J. (1994) "The economics of immigration", *Journal of Economic Literature*, 32(4):1667-1717.

Borjas, George J. (1995a) "Assimilation and changes in cohort quality revisited: what happened to immigrant earnings in the 1980s?" *Journal of Labor Economics*, 13(2):201-245.

Borjas, George J. (1995b) "The economic benefits from immigration", *Journal of Economic Perspectives* 9(2): 3-22.

Borjas, George J., Richard B. Freeman, and Lawrence F. Katz (1997) "How much do immigration and trade affect labor market outcomes", *Brookings Papers on Economic Activity*, 1:1-67.

Borjas, George J. (1999), "The Economic analysis of Immigration" Handbook of Labor Economics, 3A, 1697-1760.

Card, David (1997) "Immigrant inflows, native outflows, and the local labor market impacts of higher immigration", *NBER Working Paper No. 5927*, February.

Chiswick, Barry R. (1978) "The effect of Americanization on the earnings of foreign born men", *Journal of Political Economy*, 86(5):897-921.

Cobb-Clark, Deborah A. (1983) "Immigrant selectivity and wages: the evidence for women", *American Economic Review*, 83(4):986-993.

Collier, P. and J.W. Gunning (1999), "Explaining African Economic Performance", *Journal of Economic Literature*, 37, 64-111.

Collier P. (2000) "Ethnicity, Politics and Economic Performance" Economics and Politics 12, 225-45.

Collier P. (2001)"Implications of Ethnic Diversity" *Economic Policy* 32(16): 127-66.

Collier P and JW Gunning (1999) "Explaining Africa's Economic Performance" *Journal of Economic Literature*, 37, 64-111

Collier P. and A Hoe.er (1998) " On the economic causes of civil wars" *Oxford Economic Papers 50*, 563-73.

Collier P., and A. Hoe.er (2002), "Greed and grievance in civil wars", *Working Paper*, The World Bank.

Duleep, Harriet Orcutt and Mark C. Regets (1996) "Earnings convergence: does it matter where immigrants come from or why", *Canadian Journal of Economics*, 29:S130-S134.

Easterly, W. (2001), "Can Institutions Resolve Ethnic Conflict?", Economic Development and Cultural Change 49(4):687-706

Easterly W. and R. Levine (1997), "Africa's Growth Tragedy: Policies and Ethnic Divisions", *Quarterly Journal of Economics*, 111(4), 1203-1250.

Esteban, J-M. and D. Ray, (1994), "On the Measurement of Polarization", *Econometrica,*62(4):819-51

Fafchamps, M. (2000), "Ethnicity and Credit in African Manufacturing", *Journal of Development Economics*, 61, 205-235.

Fearon, J. and D. Laitin (1996), "Explaining inter Ethnic Cooperation", *American Political Science Review*, 90, 715-29.

Filer, Randall K. (1992) "The impact of immigrant arrivals on migratory patterns of Native workers", in: George J. Borjas and Richard B. Freeman, eds., *Immigration and the Work Force: Economic Consequences for the United States and Source Areas*. Chicago: University of Chicago Press, 245-269.

Fisman, R. (2003), "Ethnic Ties and the Provision of Credit: Relationship-Level Evidence from African Firms", *Advances in Economic Analysis and Policy*, 3(1), Article 4.

Florida, R. (2002a), "Bohemia and Economic Geography", *Journal of Economic Geography*, 2, 55-71.

Florida R. (2002b) "The Economic Geography of Talent" *Annals of the Association of American Geographers* 743-55.

Glaeser, E., J. Scheinkman, and A. Shleifer (1995), "Economic Growth in a Cross Section of Cities," *Journal of Monetary Economics*, 36(1), 117-43.

Greenwood, Michael J. (1975) "Research on internal migration in the United States: a survey", *Journal of Economic Literature*, 13(2):397-433.

Greif, A. (1993), "Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition", *American Economic Review*, 83(3), 525- 548.

Grossman, Jean Baldwin (1982) "The substitutability of natives and immigrants in production", *Review of Economics and Statistics*, 54(4):596-603.

Heckman, James J. and Bo E. Honoré (1990) "The empirical content of the Roy model", *Econometrica*, 58(5):1121-1149.

Hicks, John R. (1932) The theory of wages. New York: Macmillan.

Horowitz, D.L. (2001), The Deadly Ethnic Riot, Berkeley, CA: University of California Press.

Hong, Lu, and Scott E. Page. 1998. "Diversity and Optimality" *Santa Fe Institute Working Paper* 98-08-077

Habyarimana, J. Humphreys, M. Posner,D. and Winstein, J. . 2004. "Ethnic Identifitability: An Experimental Approach" *University of California at Los Angeles. Mimeo*.

Jackson, Susan E. and Ruderman, Marian N. eds. 1996. Diversity in Work Teams: Research Paradigms for a Changing Workplace. Washington, D.C.: American Psychological Association

Johnson, George E. (1970) "The demand for labor by educational category", *Southern Economic Journal* 37(2):190-204

Karlan, D. (2003), "Social Capital and Group Banking", *Princeton University. Mimeo.*

Katzenstein, Peter J. 1985. Small States in World Markets: Industrial Policy in Europe Ithaca, Cornell University Press

Keefer and Knack (2000), "Polarization, Politics, and Property Rights: Links between Inequality and Growth", *Policy Research Working Paper* 2418, TheWorld Bank.

La Ferrara, E. (2002a), "Inequality and Participation: Theory and Evidence from Rural Tanzania", *Journal of Public Economics*, 85(2), 235-273.

La Ferrara, E. (2002b), "Self-help groups and income generation in the informal settlements of Nairobi", *Journal of African Economies*, 11(1), 61-89.

La Ferrara, E. (2003), "Kin Groups and Reciprocity: A Model of Credit Transactions in Ghana", *American Economic Review*, 93 (5):1730-51

Laitin D (1994) "The tower of babel as a coordination game: political linguistic in Ghana" *American Political Science Review,*88(3): 622-34.

LaLonde, Robert J. and Robert H. Topel (1996) "Economic impact of international migration and the economic performance of immigrants", in: Mark R. Rosenzweig and Oded Stark, eds., *Handbook of population and family economics.* Amsterdam: North-Holland.

Lazear E (1999a) "Globalization and the market for team-mates" *Economic Journal* 109, 15-40.

Lazear E. (1999b) "Culture and Language" *Journal of Political Economy* ,Supplement, 95-125

Okten, C. and Osili. Una O. 2004. "Contributions in Heterogenous Communities: Evidence from Indonesia". *Journal of Population Economics*, 17(4):603-26

Orlando, R., Kochan, T. and McMillan-Capehart, A. 2002. "The Impact of Visible Diversity on Organizational Effectiveness: Disclosing the Contents if Pandora's Black Box" *Journal of Business and Management*, 8(3): 265-92

Ottaviano,G. and Peri, G. 2005." Cities and Cultures". *Journal of Urban Economics*, 58: 304-337

Richard, Orlando, Thomas Kochan, and Amy McMillan-Capehart.2002. " The Impact of Visible Diversity on Organizational Effectiveness: Disclosing the Contents in Pandora's Black Box." *Journal of Business and Management*, 8(3): 265-92

Rogowski, R. 1987. "Trade and the Variety of Democratic Institutions. " *International Organization*, 41(2):203-23

Roy, Andrew D. (1951) "Some thoughts on the distribution of earnings", *Oxford Economic Papers*, 3:135-146.

Schoeni, Robert F. (1997) "The Effect of Immigrants on the Employment and Wages of Native Workers: Evidence from the 1970s and 1980s", unpublished paper, The RAND Corporation, March.

Solow, R. M.(1956) , "A Contribution to Theory of Economic Growth," Quarterly Journal of Economics, 70,65-94

Tanguy,B., Janvry,A. and Sadoulet, E., 2004. " Social Resistance to Institutional Change: Explaining the Emergence of Differentiating Organizations in Rural Senegal" *University of California at Berkeley. Mimeo*

White, Michael J. and Zai Liang, Zai (1993) "The effect of immigration on the internal migration of the native-born population, 1981-90", unpublished paper, Brown University, August.

Wooldridge, J. (2002) Introductory Econometrics: A Modern Approach, 2nd Edition, South-Western College Publishing

Wright, Richard A., Mark Ellis, and Michael Reibel (1997) "The linkage between immigration and internal migration in large metropolitan areas in the United States", *Economic Geography* 73(2):234-254.